



National Aeronautics and
Space Administration

Observations & Opportunities

Safety Culture & Safety Management Leadership

Bath Iron Works A General Dynamics Company

**A Benchmarking Report Prepared by the
NASA Office of Safety & Mission Assurance
Review & Assessment Division**

October 22, 2004



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Executive Summary

The August 17-18, 2004, benchmarking activity with Bath Iron Works (BIW) provided the NASA review team with an excellent case study of corporate transformation to a strong safety culture accomplished by changing employee behavior. Beginning in 1987, BIW recognized that safety was a key element in efforts to become more competitive and remain profitable. During the 1990's, BIW launched an enhanced safety management initiative to reduce safety-related mishaps, which had profoundly affected overhead costs in terms of lost time, lost capability, lost corporate knowledge, and lower employee morale. In 1999, realizing that safety performance was still down, BIW re-doubled efforts to elevate the importance of their safety culture to the same level as corporate profitability. In 2004, BIW has shown remarkable results in the reduction of safety-related mishaps and employee lost time over the last five years.

Key observations include:

- 1.) Senior management focus on reinforcing the safety value continuously at the mid-level and worker level, including three senior management meetings per week with the President of BIW, during which safety management issues are addressed. In addition, all senior management are required to perform a shop floor safety audit once per week to reinforce its expectations.
- 2.) First-level accountability for safety lies with line supervisors; safety is co-equal with cost and schedule.
- 3.) "Scenario Safety Talks" are brief 15-minute sessions on safety that are provided every week of the year.
- 4.) A guiding principle of senior management that "to change a culture you first have to change individual behavior".
- 5.) No "silver bullets" exist in the arsenal of safety. Instead, BIW emphasizes continual senior management participation coupled with continual process improvement based on internal and external audits and the imperative to hold people accountable for safety.

The NASA benchmarking review team derived a number of opportunities with the potential to assist NASA in the transformation to a stronger safety culture. Those opportunities include:

- 1.) Increasing the personal roles and responsibilities of Center Directors and Senior Managers in communicating the safety message.
- 2.) Implementing an Enhanced Safety Culture Communication Initiative (ESCCI) comprised of multifaceted and innovative ways to engage NASA employees on a weekly basis to think about ways to influence changes in safety behavior.
- 3.) Establishing specific safety critical decision making behavior paradigms as competencies within the NASA Competency Management System (CMS) to promote employee development in these skills.
- 4.) Revitalizing NASA policies and procedures to implement a new safety culture. Current efforts to refine and clarify safety policies and procedures, and the current effort of the NASA Office of Safety and Mission Assurance (OSMA) Review and Assessment Division activities to verify compliance with requirements, are consistent with the BIW approach.

While the review team observed many good opportunities, the challenge remains in assessing how the embedded safety management leadership philosophy can translate into disciplines that will enhance NASA's safety critical decision making. It is recognized that NASA has undertaken a wide range of safety initiatives in response to the loss of Columbia and the subsequent CAIB Report. However, it can be inferred that an increased, across-the-board emphasis on safety behavior and discipline will translate to greater discipline and care in NASA's safety critical decision making processes. Further, the frequency, intensity, and depth of engagement with employees on safety issues will also benefit from an enhanced and sustained level of effort.

The review team received outstanding support from BIW senior management, including Director of Human Resources, Kevin Gildart, and Director of Environmental, Health & Safety, Dan Nadeau. Lastly, it should be noted that the BIW management was invited to participate (and has expressed interest) in future NASA-hosted NNBE benchmarking activities with the Navy scheduled to resume as NASA moves beyond final preparations for return-to-flight activities.

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1.0 Introduction

NASA External Benchmarking Activities – Background

NASA benchmarking activities with the Navy were initiated in 2002 with the formation of the NASA/Navy Benchmarking Exchange (NNBE). The NNBE was undertaken to identify practices and procedures and to share lessons learned from both the Navy's submarine and NASA's human space flight programs. The NNBE focus is on safety and mission assurance (SMA) policies, processes, accountability practices, and control measures.

In August 2002, a team was formed, co-chaired by senior representatives from the NASA Office of Safety and Mission Assurance and the NAVSEA 07Q Submarine Safety and Quality Assurance Division. During the first phase of activity July -December 2002, the NASA team closely examined the Navy submarine safety (SUBSAFE) program. Information gathered during this first phase of the benchmarking was reported in the NNBE Interim Report of December 20, 2002.

In January 2003, the benchmarking exchange continued with a visit by NAVSEA to Kennedy Space Center and with several NASA visits to NAVSEA 08 Naval Reactors (NR). This second phase provided further NASA observations concerning the Navy submarine program and focused on the Naval Nuclear Propulsion Program. Information gathered during this benchmarking phase was reported in the NNBE Progress Report of July 15, 2003.

Development of a third NNBE progress report is currently in-work. The focus of this report is Software Subgroup Report I, which summarizes the activities of this NNBE splinter group formed in August 2003. This third report also summarizes other ongoing NNBE initiatives, including NASA/Navy Quality Assurance and Engineering Investigations & Analyses Memoranda of Agreements (MOAs), the August 2003 Submarine Safety Colloquium at NASA HQ, NNBE Support to NESC, NASA Safety Critical Decision Making Training Initiative, and NASA participation in a NAVSEA SUBSAFE functional audit during February 2004.

Context of Safety Culture Change and Transformation

Following the Columbia accident, the CAIB issued its report in August 2003 with findings focused on three key areas: 1.) systemic safety cultural and organizational issues, including decision making, risk management, and communication; 2.) requirements for returning safely to flight; and 3.) technical excellence. The CAIB found that NASA's history and culture contributed as much to the Columbia accident as any technical failure.

As a result of the CAIB and related activities, NASA is working to lay out the framework for a comprehensive plan to develop and deploy an organizational culture change initiative within NASA, with an emphasis on safety culture and climate. This plan encompasses a systematic, integrated, NASA-wide approach to understanding prior and current safety climate and cultural norms. New courses of action are being explored that will change behaviors and introduce new norms to 1.) eliminate barriers to a safety culture and mindset; and 2.) facilitate collaboration,

integration and alignment of the NASA workforce in support of a strong safety and mission success culture.

Bath Iron Works (BIW) Benchmarking – Charter and Direction

In the Spring of 2004, NASA Administrator Sean O’Keefe participated in a site visit to Bath Iron Works (BIW), Bath, ME, where he observed aspects of an enhanced safety management initiative designed to change BIW’s safety culture. The result of this trip was very positive, and the Administrator recognized several potential opportunities for NASA to benefit from safety and cultural transformation lessons learned by BIW. The Administrator tasked Bryan O’Connor, Chief Safety and Mission Assurance Officer, to send a spin-off group from the NNBE team to validate the impressions and lessons learned observed during his BIW site visit. On August 17-18, 2004, NASA initiated benchmarking activities by conducting a site visit to BIW. This visit provided the NASA review team with an excellent case study of corporate transformation to a strong safety culture. In addition, the BIW management was invited to participate (and has expressed interest) in future NASA-hosted NNBE benchmarking activities with the Navy that are scheduled to resume as NASA moves beyond final preparations for return-to-flight activities.

Scope of BIW Benchmarking Activity

Previous NASA benchmarking activities with the Navy focused on product and operational/facility safety issues. The scope of the Bath Iron Works benchmarking effort differs, concentrating instead on workplace and worker safety. Meetings were conducted exclusively with individuals from the Environmental, Health & Safety (EHS) organization. Product and operational safety at BIW is conducted within other organizations not involved in this benchmarking activity.

With a focus on workplace and worker safety, this benchmarking trip offered a unique and valuable glimpse into the safety leadership and innovation demonstrated by BIW in recent years. As will be discussed in this report, many of the lessons learned and experiences of BIW in establishing safety leadership and a strong safety culture can be correlated to direct opportunities for NASA to improve safety critical decision making processes and overall safety culture.

Team Composition

The NASA Office of Safety and Mission Assurance (OSMA) review team was led by Dr. J. Steven Newman (OSMA/RAD), supported by core team members Mr. John Castellano (OSMA/RAD), Mr. Jonathan Mullin (OSMA/SARD), and Mr. Howard Kass (NASA Office of Management Systems). The NASA team also included Mr. Wilton Best of NAVSEA, who was on short-term assignment at NASA HQ at the time of this activity. Center-based core team support was provided by Mr. David Barker from Kennedy Space Center (KSC). NASA Team executive secretary support was provided by Perot Systems and ARES Corporation.

The Bath Iron Works team was led by Mr. Dan Nadeau, Director of Environmental, Health and Safety and supported by Mr. Kevin Gildart, Vice President for Human Resources. Other BIW presenters included Mr. Vince Dickinson, Ms. Laura Mathisen, Dr. Maria Mazorra, Ms. Maureen

Kenney, and Ms. Phyllis Wolfe. Mr. Blake Hendrickson provided technical and materials support for the BIW team.

Benchmarking Approach

The NASA Benchmarking team continued its overall approach for benchmarking activities, focusing in detail on five topics:

- 1.) Management and Organization,
- 2.) Requirements,
- 3.) Implementation Processes,
- 4.) Compliance Verification Processes, and
- 5.) Certification Processes.

Within this framework, three areas of Bath Iron Works' enhanced safety management initiative were evaluated:

- 1.) Workplace and Worker (Industrial) Safety,
- 2.) Environmental Management, and
- 3.) Employee Wellness.

Prior to the trip a preparatory questionnaire matrix was developed to identify key questions and areas of interest within the established framework. To help prepare for the visit and set expectations, a copy of this matrix was provided to BIW one week before the NASA visit. Of their own accord, BIW personnel showed exceptional, proactive, and thorough leadership by preparing and providing formal written responses to each of the questions on the NASA matrix. A copy of the questionnaire matrix along with the BIW responses is provided in Appendix D.

As the benchmarking trip was conducted, the focus of meetings and discussion shifted primarily to workplace/worker safety and employee wellness. Limited discussions on environmental aspects took place and are not represented in the main body of this report; however, detailed questions and answers addressing this topic are provided in Appendix D.

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2.0 Bath Iron Works (BIW) Benchmarking Background

History

Bath Iron Works (BIW) has a long history ranging from 1884 to present day. The BIW shipyard, located on the Kennebec River in Bath, Maine, is the namesake of an iron foundry established in 1826. The first BIW-built vessel was a coastal passenger ship named Cottage City built for the Maine Steamship Co. Since the completion of Hull #1 in 1890, BIW has been awarded more than 425 shipbuilding contracts, including 245 military ships (mostly destroyers and frigates for the U.S. Navy) and over 160 private yachts and commercial vessels. Since the 1950's, BIW has served as lead shipyard for 10 surface ship classes produced by the U.S. Navy, more than any other U.S. shipyard. BIW became a wholly-owned subsidiary of General Dynamics in September 1995.

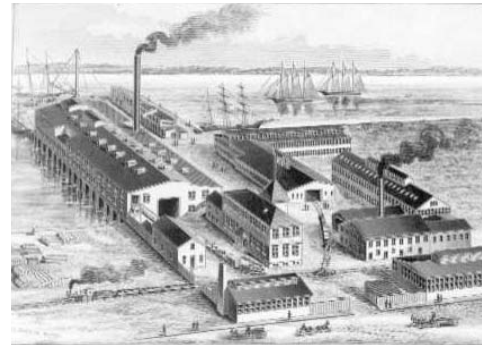


Figure 1. BIW Plant, circa 1890

In terms of modern U.S. Navy surface combatant programs, the Lead Ship construction contract for the FFG 7 Oliver Hazard Perry Class of guided missile frigates was awarded to BIW in 1973, and 24 of these surface combatants were delivered over the next 15 years. In 1982, the Navy selected BIW as second-source shipbuilder for the CG 47 Ticonderoga Class of AEGIS guided missile cruisers. The company went on to win contracts for eight of these warships, delivering the last one in 1993.

Current Production

In 1985, BIW won the competition for detailed design and construction of DDG 51 (USS ARLEIGH BURKE), the Lead Ship for the Navy's newest, most capable class of AEGIS guided missile destroyers. BIW has delivered the lead ship and follow ships, with delivery of the last follow ship expected in 2010.

Production /Manufacturing Environment

OSHA statistics show that shipyard work is traditionally hazardous. By its very nature, the work is potentially very hazardous, including tasks such as welding, blasting, grinding, cutting of metal, crane operations, manual lifting, overhead work, working at heights, ordnance operations, and large scale painting. Much of the work is done in tight spaces and requires maintaining awkward positions for extended periods of time.



Figure 2. Arleigh Burke Class AEGIS Destroyer

The production process for each ship lasts approximately 50 months and consists of four major steps:

- 1.) Fabrication - construction of major structural units,
- 2.) Pre-outfit – initial outfitting (piping, etc.) of the major units,
- 3.) Land Level Transfer Facility (LLTF) – major units are integrated together and the ship is floated, and
- 4.) Ship Completion – final detailed outfitting and delivery.

On-site, BIW has its own medical clinic and physical therapy facilities. Today BIW staffs approximately 6,500 employees (down from 12,000 in 1990) with manufacturing-related trades comprising 5,000 of those positions. There are 26 different crafts/trades employed at BIW. The employee average age is 45 with 18 years seniority. Eighty percent of the touch labor workforce is unionized, and the relationship between Union and management is an important consideration in implementing a safety culture initiative.



Figure 3. BIW Grinding Operation

Competitive Environment

American shipbuilding has declined sharply over the last 30 years. In the 1970's there were 25-30 shipyards in the U.S., a combination of publicly and privately-owned facilities. Today there are 6 remaining privately-owned shipyards and 3 publicly-owned. Currently, BIW has one primary customer – the U.S. Navy.

In 1981, the commercial market for U.S. shipbuilders collapsed when the U.S. Government unilaterally terminated its commercial shipbuilding subsidy program while foreign governments increased theirs. The U.S. soon lost its share of the international commercial market and today holds only one percent of this commercial market. Accordingly, BIW has not had a commercial customer since the termination of the U.S. subsidy program.

In the 1980's the U.S. Government embarked upon one of the largest naval build-ups in our Nation's peacetime history. This increase in naval orders helped to cushion the collapse in the commercial market. Today, however, the U.S. Navy is ordering the smallest number of naval ships since the Great Depression. The Navy's orders have averaged only six ships per year since 1994, and the naval fleet is approaching 300 total ships – down from approximately 600 in the late 1980's.

BIW faces a very tight market against competitors such as Northrop Grumman Ship Systems' Ingalls Operation. Given this environment and the safety challenges experienced in 1999, BIW management realized the need for cultural change. This was driven by the need to compete and remain profitable. Safety-related costs represented a direct lien on the corporate bottom line.

1999 Safety Catharsis

Prior to 1990, the BIW management culture was predominantly autocratic, and safety was second to production. At times, macho “tough guy” behavior was perceived on the production floor. The modern era of BIW’s Environmental, Health & Safety (EHS) program began in 1987, when OSHA conducted a Wall-to-Wall inspection and BIW received, what was at the time, the largest proposed penalty in OSHA history, \$4.1M. In 1987, the first Director of Environmental, Health & Safety was hired and tasked with ensuring that BIW had adequate programs to manage EHS issues. By 1990, the BIW lost time injury rate (LTIR) was 17.1. Over the next decade, this strong safety organization (external to manufacturing) focused on enforcement of policies, procedures, and compliance to OSHA standards. BIW showed improvement with this approach, and nearing the end of the 1990’s had managed to drive the LTIR to the mid to upper 6 range; however, the rate was again on the rise.

1999 was a difficult injury year for BIW and the LTIR was up to nearly 8. Employees submitted 5-10 employee complaints every week. OSHA formal complaints for 1999 totaled 27. Overall the BIW organization was still very autocratic with limited compliance and cooperation from the workforce. Late in 1999 Mr. Dan Nadeau (with 18 years experience at BIW) became the Director for Environmental, Health & Safety. By 2000, BIW recognized the need to change the behavior and culture of all employees (management and mechanics) regarding safety. Over the next 12-month period, a three-part approach was developed to achieve this goal.

The first part was to work collaboratively with OSHA and BIW’s Union representatives to resolve BIW’s safety issues. A partnership agreement was signed with OSHA on March 27, 2002. This agreement set BIW on the path to work with its employees and regulatory agencies to improve safety.

The second part, based in part on feedback from OSHA and the Unions, was the implementation of an extensive program to change the safety culture of management. DuPont Safety Resources was hired as an outside consultant to work with all levels of BIW management on total safety ownership. The ultimate goal of this on-going program is to change the behavior of all employees with regard to safety, and to have all levels of management embrace and ‘own’ safety. All levels of management have been trained on the DuPont methodologies in Management Safety ‘Ownership,’ Accident/Incident Investigation Process, and Safety Auditing Process.

The third part was to standardize procedures and processes into a proven and recognized system. In 2002, BIW began formalizing its EHS Management System. In February 2004, BIW became the first shipyard in the country to be both ISO 14001 Certified and OHSAS 18001 Compliant.

In the five years since 1999, BIW has made impressive improvements in their environmental, health and safety record. In that time, BIW has reduced lost time accidents by 42% and reduced recordable injuries by 40%. By 2004, the LTIR was down to 5 with goals to be below the shipyard industry average of 3.7 by 2005. There have been no employee complaints filed in three years, and there have been no formal OSHA complaints in four years.

In the current environment at BIW, manufacturing and other organizations have now accepted ownership for leading safety. The focus of the EHS organization is no longer that of 'enforcement', but rather that of a support organization to help guide the efforts of VPs, managers, and supervisors within the line organizations who lead and take responsibility for their own safety efforts. The EHS office consists of 48 people, only 4 of whom are full time safety professionals. The rest of the group consists of industrial hygienists, environmental protection specialists, marine lab personnel, and a large group of workers who serve as the assurance managers for fall protection and other hazardous operations.

3.0 Summaries and Key Observations

3.1 Industrial Safety Culture at BIW

3.1.1 Background

The course of change for BIW has included acknowledging the need for outside consultant expertise and has required a serious commitment on the part of management. Change has not occurred overnight, but instead has been an ongoing process that has involved meeting a number of significant milestones over a period of years. During the first year, the initial focus was at the management level, dealing primarily with understanding safety policies, responsibilities, work practices, and what was considered unsafe. The second year focused on how to implement and demonstrate a company-wide commitment to safety. It was at this point that BIW engaged the assistance of DuPont Safety Resources. One of the primary benefits of involving DuPont was to drive unity into the BIW leadership team. This process took over 6 months, and it is questionable that, without the outside perspective and assistance of Dupont, BIW could have achieved the necessary objective insight and associated unity required to move forward with changes to its safety culture.

The NASA Benchmarking team held discussions with several senior BIW managers about their perspective on the components/attributes of establishing a corporate safety culture. A very consistent message was presented on numerous occasions from various levels of personnel, which highlights the success of implementation and the progress that has been made at BIW.

3.1.2 Safety Culture Attributes

The NASA benchmarking team observed the following key safety culture attributes:

1.) Leadership, 2.) Policies and Procedures, 3.) Training, 4.) Compliance Verification – Audit & Review, and 5.) Follow-up / Enforcement.

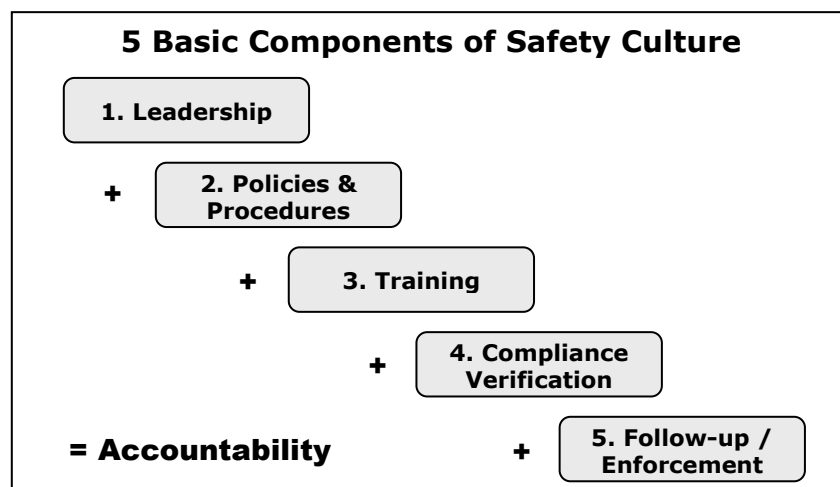


Figure 4. Safety Culture Attributes.

3.1.3 Safety Management / Leadership

BIW has implemented a system which emphasizes that safety has everything to do with leadership. Leadership involves setting expectations and then engaging the employees to change their behaviors. Only through changing behavior does culture then begin to change. In the current environment at BIW, manufacturing and other organizations have now accepted responsibility and ‘own’ the process of leading safety. The BIW Safety organization is no longer in the role of ‘enforcement’ and serves as a support organization to help guide the safety efforts of VPs, managers, and supervisors within their own line organizations. The BIW management structure is represented notionally in Figure 5.

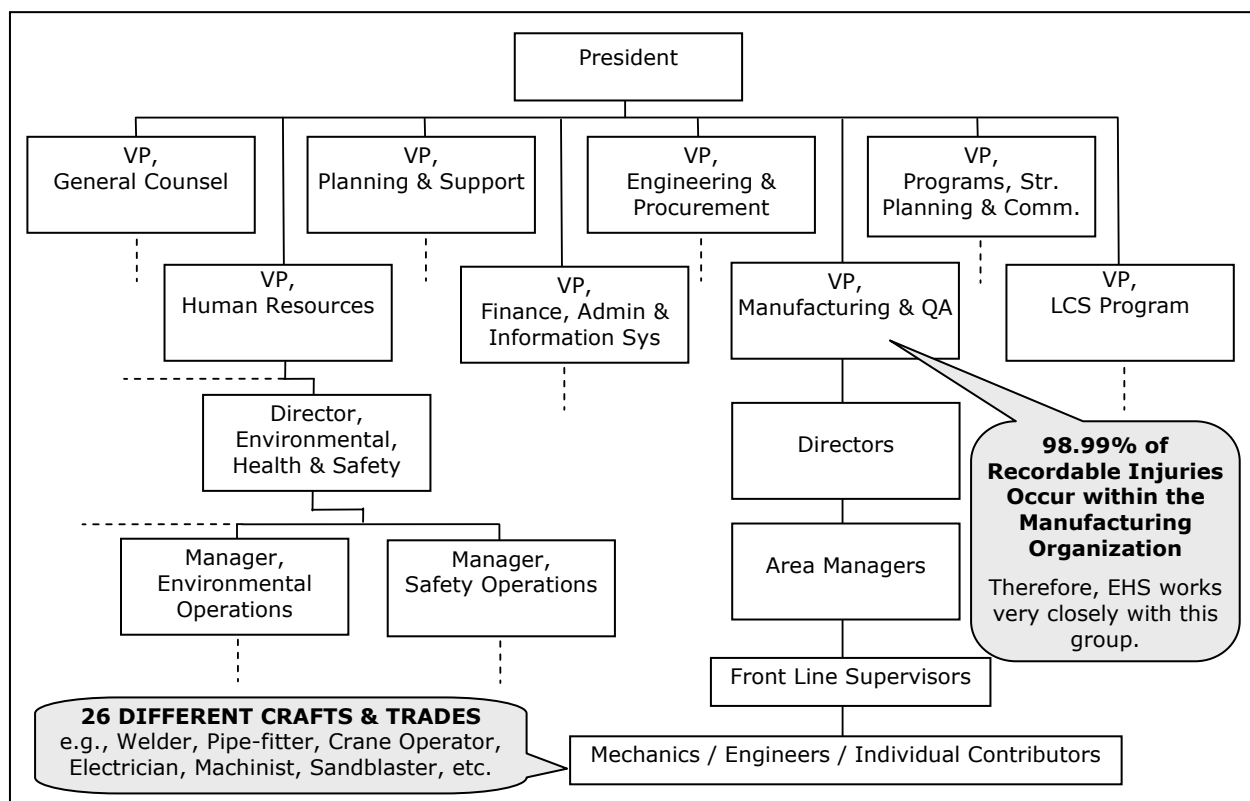


Figure 5. BIW Management Structure

The BIW management perspective on establishing safety culture includes the following components:

1.) **There must be visible, demonstrated leadership from management.**

No silver-bullet remedy exists – it requires the enthusiastic cooperation of the entire management team. As discussed earlier, this is an area in which DuPont Safety Resources was particularly effective for BIW.

2.) Management's commitment to safety must include engaging the employees (i.e., making safety personal).

This involves several factors and includes BIW senior management getting out on the production line on a regular basis to talk to the workers in a positive manner. Coming from what has been at times an adversarial relationship between management and workers, this has not been an easy step for BIW to implement. It required time and training for members of senior management to feel comfortable in this role. In recent years, BIW has also been implementing the Lean Manufacturing process, and this focus also helped management engage with employees.

3.) Leadership must follow-up with employees.

Engaging employees also means that if needs are identified, management needs to see that these are followed through in a timely manner in order to demonstrate that the commitment is real. This aspect is discussed further in section 3.1.7 (Follow-up / Enforcement).

4.) Leadership needs change employee behavior in order to change safety culture.

BIW management stated many times in various ways that "senior management must engage employees to affect behavior". This is a key ingredient in understanding the BIW experience: the way to change culture is to first change behavior. Culture will then follow and develop on its own. Without this process, shortcut attempts to affect culture will be perceived as false and insincere – in a sense, premature. The BIW experience is built on the belief that, more important than what you say, is what you do.

5.) Leadership must prioritize safety.

The BIW management team has prioritized safety as a co-equal with cost, schedule, quality and technical performance drivers. They are quick to point out that while safety is not any less important, it is also not more important. They try to avoid slogans such as "Safety is #1" and respect that safety fits within the context of getting the job done. Safety is not something separate to think about but an integral part of the job. Many times BIW has discovered that when they figure out how to do a job safer, it also becomes more efficient. The mindset encouraged at BIW is to consider how to do a job better (which is usually safer as well), rather than just how to do it faster/better/cheaper. There is a balance to be continually maintained to ensure that all aspects of corporate success are considered in key decisions, and to meet the pressures to remain competitive.

In the process of expanding their manufacturing facilities, BIW needed to relocate the 300-ton capacity crane from the old Bath shipbuilding facility to the new Land Level Transfer Facility. This process involved loading the 900 ton (total weight) crane onto a barge to transport up the river and offload to rails at the new facility.

Due to schedule issues at the time there was pressure to perform this move during the regular work week. With the potential risks posed by such an operation, the Safety organization would only support this transfer to be performed on a weekend with minimal personnel in the area. This conflict elevated to the president who ultimately decided to delay the move until the weekend, demonstrating management's true commitment to safety.

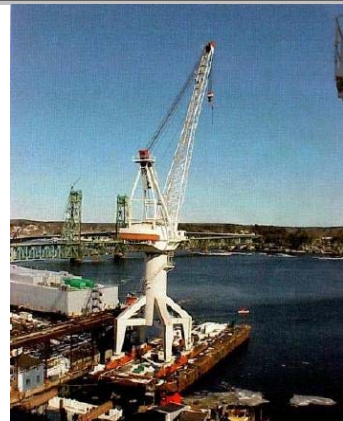


Figure 6. Relocation of 300-Ton Crane

6.) Leadership must occur at the proper level.

At BIW, the expectation has been set with the VPs to implement safety leadership within their organization and at the line management level. This places safety leadership in the hands of the people most responsible for the behavior of the workers. Behavior is 'key' – roughly 90% of a worker's personal safety is determined by their own personal behavior. Without changing this behavior, you cannot change safety.

7.) Leadership must communicate frequently and regularly.

BIW explained that the company president, RADM Dugan Shipway (U.S. Navy Ret.), has a senior staff meeting three days per week. Safety is addressed at every one of these meetings and the specifics concerning safety issues (names, processes, contributing factors) are explored.

BIW also has put in place a central safety committee which includes all layers of management. The committee meets weekly to address metrics, trends, issues and concerns. The committee provides a monthly report to the president regarding safety issues and status of the safety program.

8.) Policies and procedures must be defined, documented, and communicated to the workforce.

The system of policies, procedures, etc., must be accurate, reflect how work is actually performed, and be easily understood. At the fundamental level, the system documents the expectation for work behaviors. The following section describes the BIW safety policies and procedures in greater detail.

3.1.4 Safety Policies and Procedures

As discussed earlier, the third part of the BIW change strategy was to standardize procedures and processes into proven and recognized systems. These efforts were undertaken in 2002 and reached a milestone in February 2004, when BIW became both ISO 14001 Certified and OHSAS 18001 Compliant.

BIW Industrial Safety requirements are dictated primarily by OSHA. BIW maintains a level of ‘compliance plus’ in which standards are maintained to not only meet, but exceed the OSHA minimum standards. In addition, contracts with the U.S. Navy invoke various EHS requirements and overhaul work requires conformance to the Navy Standard Items, which include EHS requirements. Compliance with the various Navy EHS requirements is not addressed in this report.

BIW has also signed a letter of intent to pursue OSHA Voluntary Protection Program (VPP) status and is currently partnering with OSHA on this effort. BIW Safety personnel described how employees were not ready for VPP until recently and that the culture change effort had to achieve sufficient maturity before a VPP program could be undertaken with any level of success.

Policies and Procedures (Directives)

In developing change strategy, BIW management understood the importance of standardizing procedures and processes into a proven and recognized system. The measure and the goal for doing so was to achieve ISO 14001 Certification and OHSAS 18001 Compliance, both of which were achieved in February 2004.

BIW safety policies and procedures documents are contained within a hierarchical system of the following categories:

- EHS Management System Manual – describes the core elements of the Environmental, Health & Safety Management System (EHSMS) in accordance with ISO 14001 and OHSAS 18001.
- Environmental, Health & Safety Procedures (EHSPs) – the procedures referenced in the EHS Manual that contain detailed information on specific parts of the EHSMS.
- Operational Controls – related documents that provide instructions to ensure significant aspects and risks are controlled when appropriate.
- EHS Records – related documents that provide evidence that the EHSMS activities are being implemented as required.

Currently BIW maintains 16 overall EHSPs and 38 detailed safety procedures (SPMs), a detailed listing is provided as part of Appendix D. All of these documents are reviewed by the EHS department on an annual basis.

As the NASA Benchmarking team toured the BIW facilities they had the opportunity to observe a 60 ton modular section of a ship being rotated upside-down by a crane maneuver (the ships are built in modular sections, and some sections are initially constructed upside-down for ease of manufacturing). During the maneuver, multiple pieces of debris fell from inside the ship section - a minor occurrence, however, something that is not supposed to happen.

BIW President Dugan Shipway also observed the operation and quickly sought to identify the management responsible for this operation. Later, in discussions with the NASA team, Shipway stated that his goal was not to 'punish' the individuals involved, rather to find out where the process failed and to prevent recurrence. Furthermore, rather than intervene himself and override the line management authority, he would allow the responsible management to address and resolve the issue of their own accord.

The BIW philosophy is about promoting leadership and accountability, fixing the process, and respecting the individuals rather than assigning blame.

3.1.5 Training

Once a system of policies and procedures to implement processes has been put in place, employees need to be trained to make sure they understand the expectations that have been set. Ultimately, one of the primary goals of employee training is to help workers not only understand how to be safe, but also to understand that it is truly in their best interest to work safely.

BIW provides EHS training at various frequencies and consists primarily of four types of training:

- 1.) New Employee Orientation training is provided upon the employee's first day of work at BIW. The orientation addresses safety, and employees must then pass a test on the material prior to starting work.
- 2.) "Scenario Safety Talks" are brief 15-minute sessions on safety that are provided every week of the year.
- 3.) Specialized Training is typically provided on a less frequent basis as determined by regulations, contracts, or risk analysis. Examples of typical specialized training may include training on specific equipment operation, fire-fighting, video display training, ergonomics, confined space rescue, emergency responder, hazardous waste management, respirator training, crane certification, welding, etc. This type of training is typically conducted on an annual basis, but may also occur more or less frequently as dictated.
- 4.) On-The-Job Training is a critical part of any new or re-assigned employee training.

Safety Culture Communication

The Safety organization at BIW is significantly focused on training, educating, and marketing to the employees the safety culture.

The weekly “Scenario Safety Talks” were one of the highlights of the NASA Benchmarking visit. Every week for 15-20 minutes, the shipyard stops all work and supervisors go over safety topics with their workers. The format includes lessons learned and best practices in a ‘USA Today-like,’ two-page synopsis document. Examples of the materials provided by safety are provided in Appendix A.

The Safety organization develops and provides the information/presentation package to the managers, however each manager can personalize or completely change the topic for the day as they see fit. New material is continuously generated, drawing on experiences from the 26 separate trades at BIW and may be based on near misses, reportable accidents, and/or lost time accidents. The materials are also customized for each trade area and typically cover recurrent themes (e.g., use of personal protective equipment). All supervisors are held accountable to conduct this training and metrics are reported to senior management.

The weekly safety talks are an extremely positive program for many reasons, including:

- Weekly meetings not only provide regular reinforcement for the workers, they also provide a clear demonstration of management commitment to safety.
- The weekly tag-up puts the supervisors and line management directly in a leadership position regarding safety, which is exactly where it needs to be. Having safety personnel come in and conduct the talks would not be as effective at establishing a culture of safety leadership. The weekly talks clearly demonstrate how the BIW central safety organization has become more of a support organization to the other business organizations which ‘own’ safety for their particular area. In their current environment, safety personnel spend as much time as trainers and educators as they spend on any other particular specialty.



 Environmental, Safety & Health Bath Iron Works A GENERAL DYNAMICS COMPANY	Scenario Safety Talk	TAS Number: N/A	Page 1 of 1
Subject: Transporting a Welding Grid			
<p>The M16 classification has been identified as having significant risk factors that include Ergonomic hazards such as excessive force, repetitive motion, awkward positioning, and push/pull. Falls, mechanical failures, excessive noise, and their work environment also place M16's at risk for injury. A risk factor has been added to the M16 classification that was previously not identified. This scenario will describe an event that occurred that exposed the mechanic to an unrecognized hazard and potential electrical shock.</p>			
What Transpired:			
<ul style="list-style-type: none">• An M16 Materials Clerk was asked to relocate a welding grid within the PO2 facility and he used a forklift to get the job done. Earlier in the week, the M16 had placed a second welding grid in the same location. He assumed that this was the grid that he was asked to move. No one gave him any indication that it was not, so he positioned his forklift to make the move.			
			
What The Mechanic Did:			
<ul style="list-style-type: none">• The M16 placed his forks under the welding grid and as he began to raise the load a flash occurred and filled the area with sparks and smoke.			
Outcome:			
<ul style="list-style-type: none">• The M16 was extremely shaken as a result of the incident, but fortunately no one was injured. However, the M16 was placed at risk for injury when the welding grid shorted onto the forks of his forklift. Clearly, had the operator, Maintenance, or management identified the correct welding grid to be moved or visually inspected the welding grid to ensure it had been de-energized, the incident would not have occurred.			
Lessons Learned:			
<ul style="list-style-type: none">• Verify that the electrical equipment, machinery or appliance has been de-energized prior to handling or transporting.• Ensure the load you are moving is safe to move and handle it appropriately.• Do not make assumptions. Communicate clearly with others and ensure a clear plan of action has been defined. Make sure that the proper people are involved at all times.• Prior to handling or moving equipment, make sure that a visual inspection and assessment of any potential hazards has been completed. This will eliminate any secondary hazard condition and its a good practice to do this yourself.• If you ask a question of yourself and you can not find the answer, STOP, and get help from others.			

Figure 7. “Scenario Safety Talk” Example as provided in Appendix A

- The weekly meetings provide a forum to deliver and discuss lessons learned across the company. The “Scenario Safety Talk” contains a summary of a real event, such as a significant spill or inadvertent explosion/fire of flammable materials. The talk covers what happened and what went wrong, including the root cause and any new procedural changes that may have resulted. These safety talks are very popular with the employees and are an excellent training tool that also ensures that lessons learned are captured and implemented in a formal manner.

Pictures were utilized very effectively early on in the change process. At the senior management level, the EHS Director found that too much non-productive effort was spent arguing about ‘what happened’ on the production line. Often times the safety perspective was very different from the manufacturing perspective. As an alternate approach, the safety organization began taking photographs of particular hazards or unsafe practices. The photographs were then presented at management meetings to discuss “what is going on here” and “what should we do about it?” With this practice, the team could immediately agree upon the facts (the photo) and proceed towards resolution and change. Within the Scenario Talks and in other training materials, BIW often uses photos of unsafe practices paired side by side with the proper method for comparison purposes.

The Safety organization makes extensive use of pictures and graphics to tell their stories. "It's all about story-telling".

BIW employees have a proud heritage for the work that they do. This heritage can be a powerful tool for engaging the workforce as expressed by the BIW VP for Human Resources:

"Heritage allows you to cantilever into the future.
Nostalgia keeps you from going there."

Other communication and outreach approaches include shirt pocket guides, badge cards, area posters, etc. Recently the Safety organization summarized all key safety requirements in a single, pocket-sized, mini document as a quick-reference distributed to all employees. In addition, all safety and health requirements and emergency procedures are available electronically at one site on the company intranet.

3.1.6 Compliance Verification – Audit and Review

Once expectations have been established and documented and employees have been trained, a strong compliance verification process is needed to demonstrate that the company really means what it says.

Senior management and safety professionals who walk the floor checking for hazards are encouraged to perform observations only - without clipboard and pencil. The image of 'clipboard police' sends the wrong message to the workers and puts a barrier between the parties. Only after completing an observation and returning to their desk do these BIW individuals write down what they observed. This method keeps the environment on the production line positive and promotes non-threatening interactions.

**"You get the level of safety performance that you demonstrate you want."
- Environmental, Health & Safety Director**

BIW utilizes several procedures, processes, and tools to implement and manage its Safety program.

Compliance Verification/Work Review Processes

BIW utilizes a number of compliance verification processes, including metrics, audits, and incident investigation.

Safety Metrics:

BIW utilizes several safety metrics to help guide and maintain the safety process. A listing of the current safety metrics is provided in Table 1.

Table 1. BIW Safety Metrics

Type of Metric	Frequency	Receiving Parties
Universal Safety Audit	Weekly	Manufacturing VP/Directors
Days w/o Lost Time Report	Weekly	Manufacturing VP/Directors
Lost Time (frequency/severity)	Weekly	Manufacturing VP/Directors
Safety Talk Performance	Weekly	Manufacturing VP/Directors
Shift Comparison Matrix	Weekly	Manufacturing VP/Directors
Area Statistical Packages (assembly)	Weekly	Manufacturing VP/Directors
IIR Performance Report	Weekly	Manufacturing VP/Directors
Daily Injury Notice Log	Daily	All Supervision
Area Supervisor Matrix	Weekly	Area Supervisors
First Line Supervisor Recordable/Lost Time Injury Report	Monthly	Manufacturing VP/Directors
End of Month Statistics (Senior Management Report)	Monthly	Senior Management/Directors
Weekly Statistics (actual vs. limits)	Weekly	All Supervision
Field Guide	Monthly	Senior Management/Directors
End of Month Detailed Trade Analysis	Monthly	Manufacturing VP/Directors
Multi Injury Employee Report	Weekly	Manufacturing VP/Directors

Safety Audits:

At BIW, audits are as much about finding things that are right as are wrong. The purpose of an audit is to simply measure where you are to date versus where you want to be. Ultimately the goal of auditing is to be able to stop auditing because this checking function is happening automatically as part of the daily routine of all workers. Safety audits are an important part of the overall safety culture to measure the status of the program versus goals and objectives. Table 2 summarizes the Environmental, Health & Safety audits conducted at BIW:

Table 2. BIW Environmental, Health & Safety Audits

Audit Type	Frequency	Whom
EHS Management System	Monthly	EHS Staff
Safety Inspections	Daily	EHS Staff
Scheduled inspections or audits	Varies according to schedule	Represented EHS Staff
Wall-to-Wall	Monthly	EHS Staff, Production, Maintenance
Behavior Audits	Weekly	All Management

BIW has instituted daily safety audits by safety inspectors and monthly simulated OSHA audits by the Safety organization. All managers and supervisors are required to perform and document at least one safety audit a week. On a weekly basis, each manufacturing area consolidates all audit findings to identify the root cause highest contributors. Based on the findings, an action plan is set to influence change the following week. Success is measured on a monthly basis. Leading Indicator Audits were instituted to identify unsafe acts and conditions. Trailing indicator audits were instituted to find out why an injury occurred and how to prevent recurrence.

Incident Investigation / Root Cause Analysis:

A ‘root cause’ is defined at BIW as:

- the origin of an event which when corrected most minimizes the probability of recurrence.

BIW places tremendous emphasis on preventing recurrence and works equally hard to minimize assigning blame. The overall goal is to fix the process so that future incidents are avoided. Injury investigation and root cause analysis are important at BIW to:

- 1.) Prevent recurrence,
- 2.) Identify inadequacies in processes and procedures,
- 3.) Identify improvement needs to the work environment,
- 4.) Raise expectations on safety awareness, and
- 5.) Foster employee involvement.

In determining root causes, BIW personnel ask ‘why’ at least 5 times as the investigation takes place to assure sufficient depth of analysis. BIW does not get overly concerned with identifying the one root cause for a given incident. Rather, contributing causes are also identified and given equal weight in the resolution process.

Primary mishap investigation is performed by line management and must be completed and documented within 24 hours. The safety organization tracks the results of root cause investigations and maintains records by job trade of what factors are leading to worker injuries. This type of analysis taxonomy provides insight into corrective actions and also serves as a basis for future incident analyses (i.e., what rocks to look under).

The results of worker injury Root Cause Analyses are grouped into the following categories for reporting and trending purposes:

Table 3. BIW Root Cause Assessment Categories

No Training	Ship Design	Rule/Policy Violation
Inadequate Training	Repetitive Motion	Environmental Conditions
Mechanical Failure	Static Posture	Inattention to Job Details
Wrong Tool for the Job	Awkward Position	Recurring Injury
Slip Hazards	Improper Lifting	Non-occupational
Trip Hazards	No PPE	Inadequate Maintenance
Lack of Postings	Inadequate PPE	Excessive Force
Employee Behavior	Housekeeping	Exposure Reaction
Cutting Corners	Kneeling	Hand Tool (vibratory)
Poor Work Practice	Walking/Working Surfaces	Poor Lighting
Poor Job Setup / Sequence	Ship Design	Unknown

Compliance Certification Processes

EHS Management System (EHSMS):

BIW completed ISO 14001 Certification and OHSAS 18001 Compliance for its EHSMS in February 2004. A re-certification process occurs every 3 years. In addition to these certifications and the audits identified previously in Table 2, BIW also has two surveillance audits per year of the EHSMS conducted by a certified registrar.

Manufacturing and Support Equipment:

Numerous types of equipment are needed to ensure safe operations and that employees are protected. These include respirators, personal protection equipment (PPE), monitoring equipment, equipment guards, fall protection, etc. In order to manage risk, considerable equipment is required and therefore certifications are tracked and maintained on all such equipment. Additionally, critical EHS equipment is identified in a Maintenance Management

System to ensure it is routinely inspected and maintained, and relevant EHS monitoring equipment is tracked in a Calibration Database to ensure calibration is maintained.

3.1.7 Follow-up / Enforcement

Follow-up is always important, but does not always have to be a formal or significant process. BIW VPs frequently walk the production line to inspect processes and engage the workers. Occasionally the management will learn that a worker may need (or appreciate) some new piece of personal equipment (such as a new pair of safety glasses) to help make the job easier and safer. In such cases, it is extremely important for that VP to ensure the glasses are provided in a timely manner. It is equally as important for that VP to personally follow-up with the worker – a simple “how are those new glasses working out?” This is a very simple step but sends a very powerful message that reinforces a community of respect.

With all other aspects of safety culture put in place, the final step is holding people accountable to the policies and expectations. This overall function may be termed enforcement. In general, BIW follows a 3-step process of enforcement. The first step involves positive reinforcement. When a problem is encountered with an employee or supervisor, that person is engaged in a positive manner. For example, the discussion would basically involve: “here’s the situation we have, what can you do to take ownership and help make some changes to correct this?” In the vast majority of cases this is all that is required to set an employee back on track. In those cases where a direct order has been violated, the next step involves formal discipline and consequences. And finally, if discipline is still ineffective an employee will be terminated.

In the midst of the BIW change process, there was an incident in which a supervisor directed workers to violate safety procedures to complete a job. In spite of this person being a valuable member of the BIW team, management made the tough decision and let the person go – such behavior in a leadership position could not be tolerated.

An incident such as this is unfortunate but sends an important message to the workers. Conversely, allowing behavior like this to go unchecked would also send an important message to the workers – the wrong message.

By allowing the line-level organizations to provide their own enforcement and leadership of safety, the Safety organization then has the opportunity to lead and coordinate the overall corporate safety effort.

3.2 Environmental Management

Limited discussions on environmental aspects took place during the technical interchange meetings conducted at BIW on August 17-18, 2004. Hence, specific observations on

environmental aspects are not represented in the main body of this report; however, detailed questions and answers addressing this topic are provided in Appendix D.

3.3 Employee Care and Wellness

BIW has put in place very comprehensive programs for employee care and assistance. These programs demonstrate the BIW core values that the workforce is part of the Corporate Family, and that the best interests of the employees (i.e., employee wellness) are also the best interest of the company. These programs are outlined in the following sections:

- 3.3.1 Ergonomics
- 3.3.2 Case Management
- 3.3.3 Physician Outreach
- 3.3.4 Employer Health Coalition
- 3.3.5 Wellness Programs

3.3.1 Ergonomics

65-70% of the injuries at BIW are soft tissue injuries, termed “strains and pains”. Ergonomic injury prevention has a significant impact on the BIW business case. For example, the average cost of an injury by the time the employee returns to full capacity is \$30-\$35K.

BIW places significant emphasis on ergonomic intervention – finding better ways to do the job and prevent injury. Examples of proactive ergonomic intervention include:

- For problem tasks as identified by workers or medical staff, or as a result of an injury, an ‘Ergonomic Assessment Work Site Evaluation’ is performed. This analysis consists of a complete job description, employee interview, division of the job into discrete tasks, and identification of risk areas for each task. Most importantly, recommendations are made to improve the task with both short and long-term solutions and preliminary measures are initiated with the evaluation. Appendix B provides examples of two ‘Ergonomic Assessment Work Site Evaluations’: one from the manufacturing environment and one from an office setting.
- For each defined trade (electrician, pipefitter, welder, etc.), a physical task analysis (PTA) has been performed. BIW job candidates must undergo a physical examination and the PTA is used to ensure candidates are a proper fit for the position being considered. The PTA is also used to assist physicians in setting employee work limits based on physical capabilities. This is discussed further in the section 3.3 (Physician Outreach). The PTA is similar to the Job Hazard Analysis (JHA) used within parts of NASA and includes the following components:
 - General job description,
 - Tools and equipment used,
 - Hours per day spent sitting, standing, and/or walking,
 - General job tasks (e.g. climb ladders, kneel, twist, balance, etc.),

- Repetitive motions required,
 - Hand/wrist/arm tasks (e.g. hammering, pinching, vibratory tools, etc.),
 - Physical activity required (e.g. lifting, carrying, reaching),
 - Static/awkward positions, and
 - Working environment (e.g. temperature, illumination, etc.)
- Adjustable office workstations and hydraulically adjustable workbenches are used where possible to minimize ergonomic injuries. This equipment allows for proper adjustment of work areas in a three shift a day environment where many different personnel of different sizes utilize the same workspace.
 - All employees in manufacturing positions are put through a “Back School” on a recurring basis. The program consists of a video produced by BIW, a lecture, and a demonstration performed by one of the company nurses. There is usually a significant drop in lifting related injuries for several months after a back school is conducted.

Overall, BIW encourages and collects worker input on ways processes or equipment can be improved. Based on such input and analysis, BIW may purchase new tools and equipment, redesign work spaces, or revise work procedures to ensure jobs are performed safer and with less wear-and-tear on the body. Significant safety initiatives generally must be justified based on long term cost reduction to the company with a minimum rate of return of 3 to 1. In most cases, the cost of new equipment is small compared to the savings in medical bills, workers’ compensation, and lost time.

3.3.2 Case Management

At BIW, case management is a multidisciplinary process that involves employee assessment, diagnosis needs, development and implementation of a treatment plan, and evaluation of the treatment plan outcomes while constantly communicating with the employee, medical provider, risk manager, labor management, and the case manager. BIW takes a very active role in employee treatment cases to ensure that workers are receiving the best possible care in a timely manner. Some highlights of the case management effort include:

- Case management personnel are available 24 hours a day to support the BIW three shift operation.
- Case management personnel will assist employees with non-work related medical treatment if requested by the employee.
- The medical department documents and tracks treatment outcomes by doctor and hospital and uses this information in selecting doctors for referral.
- The medical department maintains a resource book that includes all of the doctors used for compensable injuries that provides a great deal of information about each doctor and their success rates with different procedures.
- One of the criteria used in determining doctors for referral is whether or not they show respect for their patients. If a doctor’s office or medical facility does not treat patients with dignity and respect, they are not used by BIW.

If a BIW employee goes to the hospital, the employee's supervisor generally goes as well to ensure proper care and communication with the employee's family. In some cases, the area director will also interface with the employee and family.

3.3.3 Physician Outreach

The BIW Physician Outreach program is an integral part of the case management process. The program seeks to assure definitive and aggressive early intervention of employee health problems, to accommodate employee workloads prior to surgical disability, and to ensure definitive treatment for a rapid recovery and return to work. National statistics indicate that after 3 days out of work an employee's desire to return decreases and bad habits increase, therefore, in addition to cost issues, BIW works to keep employees on the job as much as possible.

BIW works with local physicians to promote two-way communication about needs and capabilities. The BIW Physician Outreach program consists of several elements:

- BIW provides healthcare providers with a "Healthcare Provider Resource Guide When Treating BIW Employees" to help the providers develop a better understanding of BIW's facilities, manufacturing processes, and various employee job functions. The Resource Guide provides guidance to physicians on how to determine employee work capability limitations within discreet guidelines.
- BIW provides local physicians with facility tours and demonstrations of work practices to help educate them about BIW and the types of work performed.
- BIW conducts orthopedic surgeon surveys to gather information on their capabilities and practices that will assist in assigning employee care.
- BIW provides healthcare providers with the Physical Task Analysis documents discussed previously to help them understand the patient's specific responsibilities at work and make informed decisions concerning work limit setting.

3.3.4 Employer Health Coalition

Healthcare is a major cost driver for BIW. As such, BIW is actively involved in health alliances and health care advocacy to improve medical care and treatment of patients and decrease health care costs throughout the state. The health coalition efforts have verified that there is considerable variation of care provided at hospitals and that some hospital safety systems are inadequate. BIW is self insured for both workers compensation and personal medical insurance. In support of this, they have a very strong health, medical, and wellness programs with in-house physicians, nurses, physical therapists and case managers.

BIW participates in the Maine Health Management Coalition (MHMC) which is committed to measuring and reporting on the value of health care services. Performance data is published for employee use and also used for physician rewards and recognition. In recent efforts, the MHMC developed a 'Hospital Report Card' of 8 local facilities and sent this information to employees to help them and their families make a good, informed choice as to which hospitals to use.

3.3.5 Wellness Programs

BIW has provided an employee wellness program for the last four years. Some highlights of the program include:

- The wellness program is run by a 14 member committee representing a cross section of the company. The program is employee run based on what the employees want.
- The program conducted interest surveys to determine employee needs and priorities in the areas of retirement, fitness, nutrition, and stress management.
- BIW employees come from a very large geographical area covering five counties and they wanted activities near where they lived, not at the workplace. Instead of on-site facilities and activities, reimbursement is provided to employees for specified health-related activities in their community, such as joining a fitness center or attending a smoking cessation program.
- The wellness program website posts ‘winning’ badge numbers on its site to encourage employees and their families to visit the site. If an employee’s badge number is posted and they see it, they can claim a small prize.

4.0 Opportunities

The following discussion offers potential improvement and enhancement opportunities as the NASA transformation continues toward a more uniform and more elevated safety culture.

Opportunities have been organized into four topical groups:

- Group I: Safety Culture Leadership
- Group II: Safety Culture Communication
- Group III: Safety Management Processes
- Group IV: Employee Care and Assistance - Corporate Family

Group I: Safety Culture Leadership

An exciting aspect of the BIW Benchmarking effort is the demonstrated real-life example of a dedicated and successful effort to change culture. BIW emphasized that the key to changing their culture was changing the behavior of their employees and that BIW leadership needed to engage the workforce in order for this to happen. This top-down approach to affect worker behavior resulted in culture change from the bottom up. Following the Columbia accident and the CAIB investigation, NASA is already in the midst of a culture change effort. The following are potential leadership opportunities learned from BIW that may assist the NASA safety culture change initiatives.

Opportunity #1.1: Establish More Formal and More Frequent Senior Leadership Discussions

The NASA Administrator may wish to explore proactively building safety management leadership and unity across the Agency. Regular mechanisms (retreats, dedicated programs, etc.) could be provided to foster leadership unity and better communicate the NASA Administrator vision of safety. One example would be to conduct ½ day or 1½ day Safety Critical Decision Making (SCDM) training sessions for NASA senior leadership. Also, quarterly Senior Management safety training events could be facilitated by the OSMA in coordination with ‘One NASA’ staff.

Opportunity #1.2: Perform ‘Safety by Walking Around’

The NASA Administrator and Chief Safety and Mission Assurance Officer may wish to explore with the Center Directors ‘safety by walking around,’ that is, having the Center Directors assume a safety leadership role involving their frequent, physical presence in areas with potential hazardous activities or operations. This safety variant of the ‘Management by Walking Around’ philosophy has proven effective at BIW in demonstrating top management safety leadership.

Opportunity #1.3: Establish NASA Employee Safety-Related Behavior Paradigms

BIW culture change was formed by concentrating on worker behaviors. The OSMA may wish to explore working with the Office of Human Capital Management to develop specific safety-related behavioral paradigms for particular job positions and functions that require safety critical decision making. These behavioral paradigms would be identified as competencies in the NASA Competency Management System (CMS). Identifying safety-related competencies in the CMS would open a variety of opportunities to promote safety culture change through employee development, continuous learning, workforce planning, etc.

Group II: Safety Culture Communication

BIW strengths in the area of safety culture communication provide potential opportunities for NASA to establish an Enhanced Safety Culture Communication Initiative (ESCCI). The ESCCI would engage NASA employees with weekly and monthly safety programs to influence changes in behavior.

Opportunity #2.1: Implement Weekly Safety Case Studies

One of the key themes observed while benchmarking with BIW was the institutionalization of weekly safety talks presented by management directly to employees. The OSMA, in cooperation with the Chief Engineer, APPL, and ‘One NASA’ staff, may wish to explore developing and distributing weekly case study material based on aggregated mishaps and close call events. This material would be implemented via weekly, 15-minute safety talks at the line management level to emphasize safety awareness on a regular and frequent basis. Certain safety case studies could be tailored to specific work areas/professions as appropriate. For example, trade work areas may focus on industrial safety, engineering may focus on product safety, management may focus on safety critical decision-making issues, etc. Lessons learned and best practices could also be drawn upon for case study material.

It is recognized that NASA has undertaken a wide range of safety initiatives in response to the loss of Columbia and the subsequent CAIB Report. However, it can be inferred that an increased, across-the-board emphasis on safety behavior and discipline will translate to greater discipline and care in NASA’s safety critical decision making processes. Further, the frequency, intensity, and depth of engagement with employees on safety issues will also benefit from an enhanced and sustained level of effort.

Opportunity #2.2: Conduct Monthly Safety Colloquia

BIW has experienced tremendous success connecting with the industrial workforce through similar outside speakers. In one case, the speaker was a former industrial worker (named Charlie) who did not regard safety as a priority and operated with a ‘macho’ and ‘it won’t happen to me’ mindset. Charlie had an accident on the job and was severely burned – impacting all areas of his life. The message had a powerful impact on the workforce to the point that they requested a large ‘Remember Charlie’ banner be hung on the outside of one of the buildings.

The OSMA may wish to explore working with APPL to identify 12 speakers to rotate among NASA centers and provide a monthly safety and risk management case study lecture. Such speakers have been utilized at annual Safety Day events, and NASA may wish to consider moving to a monthly basis to increase emphasis to the workforce. Such outside speakers can often times deliver an impact greater than that possible by in-house personnel alone.

Group III: Safety Management Processes

Robust and clearly documented safety processes and procedures are a key element of the BIW safety culture.

Opportunity #3.1: Revitalize NASA Safety Policies and Procedures

The OSMA may wish to explore assisting safety culture change implementation through continued and expanded initiatives to revitalize NASA safety policies and procedures, including ensuring that safety policies and procedures are clearly documented and aggressively communicated to the NASA workforce. Current efforts to refine and clarify safety policies and procedures, and the current effort of the OSMA Review and Assessment Division to verify compliance with requirements, are examples consistent with the BIW approach.

Group IV: Employee Care and Assistance - Corporate Family

BIW has an improving safety program and a very impressive health and medical program. While some of what they do cannot be implemented by NASA due to the unique requirements of the Federal Government, there are many things that can be adopted in part or whole in order to improve NASA's safety and health programs.

Opportunity #4.1: Perform Ergonomic Evaluations

The NASA Occupational Health Director may wish to consider a formal Ergonomic Assessment Work Site Evaluation program to aggressively seek and implement ergonomic improvement. Ergonomic evaluations could be requested by employees or may be required in the case of ergonomic-related injuries. Ergonomic improvements may involve changes to work procedures, improved work equipment (such as hydraulically adjustable workbenches), ergonomic chairs, etc.

Opportunity #4.2: Conduct Ergonomic Training

Current training initiatives are mostly applicable to safety professionals and people working in specialized areas and are not geared toward the general workforce. The NASA Occupational Health Director may wish to explore training for large portions of the workforce in practical safety topics (such as proper lifting), and make it available to both the civil service and contractor workforce.

Opportunity #4.3: Implement a Physician Outreach Program

For NASA Centers which have a potential for significant workforce lost time injuries, the NASA Occupational Health Director may wish to explore educating physicians in the local communities on the types of work performed at the Centers and providing them with Physical Task Analysis (PTA) information for the various NASA job types. This education would help the local doctors treat work related injuries and make educated decisions regarding the need for patient work limitations.

Follow-on Activities:

1. The NASA Occupational Health Director may wish to review the BIW occupational health materials for more specific details and further benchmarking of the BIW programs.
2. These benchmarking trips are excellent opportunities for Center safety and health personnel to learn new and better ways of doing things. While these personnel can read the reports that are generated, it is not nearly as effective in transferring benchmarking information as actually going to the site and individually participating. The OSMA should identify ways to inform and include additional Center representation on future benchmarking activities.
3. BIW management has been invited to participate (and has expressed interest) in future NASA-hosted NNBE benchmarking activities with the Navy scheduled to resume as NASA moves beyond final preparations for return-to-flight activities.

Appendices

Appendix A: Examples - Scenario Safety Talk

Appendix B: Examples - Ergonomic Assessment Work Site Evaluation



Appendix C: Agenda for On-site Benchmarking Activity

Appendix D: Benchmarking Preliminary Question Matrix and BIW Responses

Appendix E: Glossary

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Appendix A: Examples - Scenario Safety Talk

	Environmental, Safety & Health Bath Iron Works A GENERAL DYNAMICS COMPANY	Scenario Safety Talk	TAS Number: N/A	Page 1 of 1
Subject: Transporting a Welding Grid				
<p>The M16 classification has been identified as having significant risk factors that include Ergonomic hazards such as excessive force, repetitive motion, awkward positioning, and push/pull. Falls, mechanical failures, excessive noise, and their work environment also place M16's at risk for injury. A risk factor has been added to the M16 classification that was previously not identified. This scenario will describe an event that occurred that exposed the mechanic to an unrecognized hazard and potential electrical shock.</p>				
<u>What Transpired:</u>				
<ul style="list-style-type: none">• An M16 Materials Clerk was asked to relocate a welding grid within the PO2 facility and he used a forklift to get the job done. Earlier in the week, the M16 had placed a second welding grid in the same location. He assumed that this was the grid that he was asked to move. No one gave him any indication that it was not, so he positioned his forklift to make the move.				
<u>What The Mechanic Did:</u>				
<ul style="list-style-type: none">• The M16 placed his forks under the welding grid and as he began to raise the load a flash occurred and filled the area with sparks and smoke.				
<u>Outcome:</u>				
<ul style="list-style-type: none">• The M16 was extremely shaken as a result of the incident, but fortunately no one was injured. However, the M16 was placed at risk for injury when the welding grid shorted onto the forks of his forklift. Clearly, had the operator, Maintenance, or management identified the correct welding grid to be moved or visually inspected the welding grid to ensure it had been de-energized, the incident would not have occurred.				
<u>Lessons Learned:</u>				
<ul style="list-style-type: none">• Verify that the electrical equipment, machinery or appliance has been de-energized prior to handling or transporting.• Ensure the load you are moving is safe to move and handle it appropriately.• Do not make assumptions. Communicate clearly with others and ensure a clear plan of action has been defined. Make sure that the proper people are involved at all times.• Prior to handling or moving equipment, make sure that a visual inspection and assessment of any potential hazards has been completed. This will eliminate any secondary hazard condition and its a good practice to do this yourself.• If you ask a question of yourself and you can not find the answer, STOP, and get help from others.				



Subject: Fall From Exhaust Vent

The design of a DDG creates many challenging work areas for a mechanic. Care must be taken by each manager, supervisor, and employee to ensure that a work space has been properly prepared and is safe for each person assigned to work there. Sometimes, to ensure a job is performed safely, additional planning and set-up is required. When additional time is not taken or proper planning not performed, a serious injury may occur.

What Transpired:

- An insulator was assigned to patch and tape the overhead insulation above a Generator #1 exhaust pipe. The mechanic climbed over a six foot step ladder and onto the top of the exhaust pipe. The mechanic began to perform the task assigned while lying on her back - working on the overhead.

What The Mechanic Did:

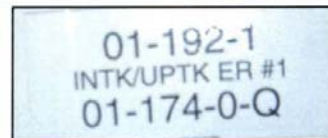
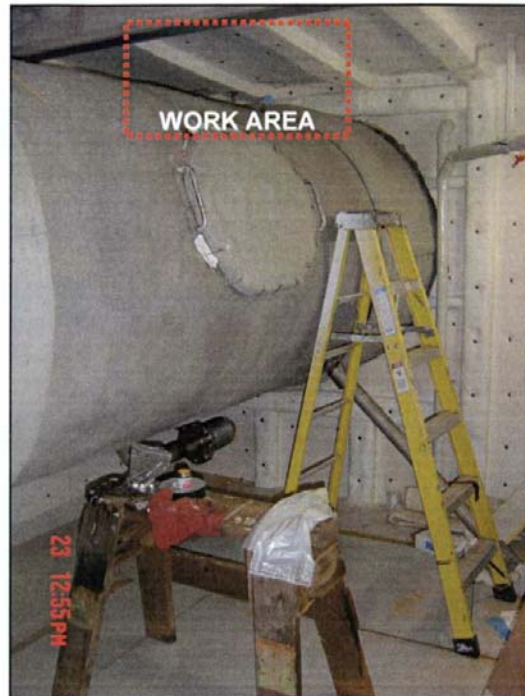
- While on her back, the mechanic decided to get down and began to slide down from the exhaust pipe to the ladder. However, the ladder could not be seen or felt with her feet. The mechanic mistakenly slid off the top of the exhaust pipe and past the ladder.

Outcome:

- Missing the ladder, the mechanic fell to the deck sustaining multiple injuries. The mechanic was transported by ambulance to Mid Coast Hospital where she was treated and released. This was a lost time injury.

Lessons Learned:

- Prior to assigning a job, management must ensure that a proper and secure work surface, platform or ladder access is provided.
- A step ladder was used improperly by exceeding the top two treads of the step ladder. This was a violation of BIW safety policy and well as the manufacturers safe usage guidelines.
- The employee can not leave the working profile of a step ladder at any time.
- The mechanics was working at a height greater than five feet and was not provided with a method of fall protection or approved work surface.
- The mechanic placed herself at risk by working in a position where the ladder access could not be viewed.
- Because this area was difficult to work, a pre-meeting to discuss how the task could be accomplished should have been conducted.





Subject: WORKING WITH PROPANE

Liquid Propane is used as a fuel source for many pieces of equipment within the Company. The Hardings facility Bayco oven is an example of a specialized piece of equipment which is used for burning (removing) paint buildup from hooks and hangers following the coatings process. The oven automatically runs through a timed cycle as two propane fired burners maintain a constant chamber temperature that effectively incinerates the paint coatings - exposing a clean steel surface. The Bayco oven can be easily operated and we have done so for years without incident. However, the potential always exists to have a serious incident if we do not follow the proper startup sequence or complete equipment repairs. When we don't follow proper work practices we place co-workers and friends at risk for serious injury. The following scenario describes an incident that resulted in an explosion of the Bayco oven.

What transpired:

The Bayco oven was removed from service by Maintenance because the burners would not remain lit and the proper oven temperature could not be maintained. A qualified and licensed contractor was hired to troubleshoot and perform the repairs.

What the mechanics did:

The technician used the manufacturer's equipment manual to troubleshoot problems, order parts and make repairs and adjustments prior to the startup of the equipment. According to the manual everything pertaining to the repair was done correctly. However, the technician failed to reinstall a 3/8" plug in the propane fuel line and did not open the oven chamber door prior to activating the startup cycle. The technician attempted to start the oven two times prior to the explosion - the system automatically shut itself down each time.

Outcome:

- Because the 3/8" fuel line plug was not reinstalled an excessive quantity of propane gas collected around the Bayco oven and within the wooden enclosure. Also, because the oven chamber door was not opened prior to the startup of the burner propane gas collected within the oven chamber. These conditions were compounded by the fact that two failed start-up had occurred.
- As the technician initiated a third start-up cycle he left the building and waited for the burner to fire. As the burner engaged an explosion occurred.
- The excess propane fuel created an explosive environment. A spark from the furnace igniter or the electrical windings of a vent blower provided the source of ignition.
- The technician could have been seriously injured if he had not stepped outside of the building. He was struck by a plywood door and forced against a waste dumpster.
- The building and Bayco oven were destroyed.
- The technician did not follow the manufacturer's operating instruction as it pertained to a non-vented oven chamber and the startup of a primary burner. Also the Technician did not inspect his work to ensure the fuel line 3/8 plug was reinstalled.


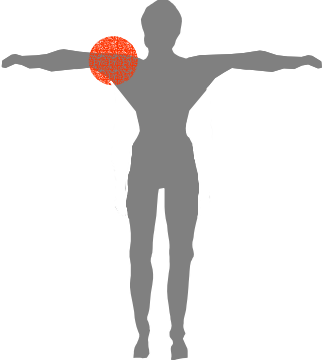


Lessons Learned:

- Always inspect your work thoroughly and ensure that all safety precautions have been taken.
- Follow at all times the manufacturer's operating guidelines. If you're not familiar with equipment - do not operate it!
- **KEEP SAFETY IN MIND AT ALL TIMES AND EXPECT THE UNEXPECTED!**



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Appendix B: Examples - Ergonomic Assessment Work Site Evaluation

 Ergonomic Assessment Work Site Evaluation		Bath Iron Works A GENERAL DYNAMICS COMPANY	
		Survey No.	060403-1220-Bath
Location: Bath	Name:	Date:	Analyst: Chris Barbor
Work Site: Machine Shop	Badge:	Dept.:	
Medical Number: NA	Date of injury:	Supervisor:	
		Problem / Complaint Description: At the request of Maria Mazorra, MD I reviewed the work site of this employee. He operates a Sharp 10 E Milling Machine in the north end of the Machine Shop, where he mills various metal parts, i.e. door parts, liners, hand wheel adapters, bolts, etc. Mechanical material handling assist is provided by a one-half ton jib crane with a manual chain fall. It is the chain fall process that is of concern to this employee and other employees in the immediate area re: the risk of injury to shoulders and upper extremities.	
Amb. Temp: 74.1 dg F		Tools: metal dyes, jigs, fixtures, hammer, straps, jib crane, chain fall	
Shift: 1st	Duration: 8 hrs	Light Level: 37 FC	Requested by:
Job Analysis: 		Risks: <ol style="list-style-type: none"> 1. Repetitive flexion / extension bilateral shoulders secondary to pulling crane chain fall. 2. Forceful pulling of jib crane (travel) secondary to load transfer. Excessive force was demonstrated as follows: (Chatillon DMG 250 dynamometer) Initial force required without load: 75pounds Initial force required with load: 100 pounds Maximum acceptable force for pull (males): 73 pounds (Snook and Ciriello revised tables) 3. Excessive weight lifted secondary to manual material handling of machine chucks, space savers, and dyes from work table / shelves to machine (maximum weight of 103#). NIOSH Lifting Index: 1.13 for this task with a recommended weight limit (RWL) of 45 pounds. (See attachment.)	
Pictured above: employee demonstrates hand-over-hand pulling task when transferring a necessary piece of equipment. The employee must pull the crane chain fall multiple times to raise the load from a resting position to an appropriate height. The load moves in approximate one-inch increments for each complete pull, causing the employee to complete approximately 15 to 20 pull cycles per load. Crane use varies between 1 to 6 times per day.			



Ergonomic Assessment Work Site Evaluation

Bath Iron Works
A GENERAL DYNAMICS COMPANY

Survey No.

060403-1220-Bath



Examples of “torquing” tasks and forceful hand and arm movements required when operating the milling machine.

There are multiple hand movements required to perform this job.

The work is moderately self-paced and the employee is usually able to vary his tasks and sequence the job as necessary.



Recommendations:

1. Electrify the jib crane as feasible to minimize forceful, repetitive pulling of chain fall.
2. Interim modifications should include:
 - slowing the pace at which the employee pulls the chain fall
 - proper job sequencing to minimize frequency of load transfers
 - use mechanical assist vs manual material lifting as much as possible
3. Consider stretch program prior to and during the work shift. ADVISED


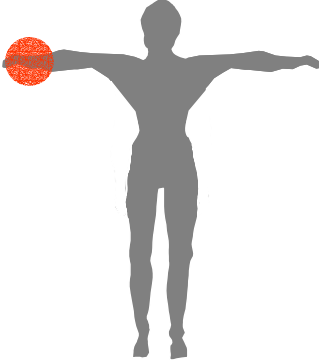



Summary:

The majority of tasks involved in the performance of this and similar jobs in the Machine Shop are very hand and upper extremity-intensive. It is difficult to determine which of these tasks poses the largest injury risk. Maneuvering the crane chain fall, however, poses a significant risk to the shoulder. By minimizing the force necessary to operate the crane, it is expected that the frequency of its use would markedly reduce the amount of MANUAL material handling that currently exists.

Strong consideration for the installation of an electrically controlled jib crane should be included in the upcoming Machine Shop LEAN initiative. I have discussed this with Process Control Engineer Murray Howard.

(Employee Name) has the support of his first line supervisor (Employee Name). (Employee Name) has agreed to reinforce the above interim recommendations. I dispensed a pair of “grip gloves” to (Employee Name) to be used when performing manual material handling tasks. I cautioned him NOT to use them when operating the milling machine.

cc. MED file
ERG file

 Ergonomic Assessment Work Site Evaluation		Bath Iron Works A GENERAL DYNAMICS COMPANY	
		Survey No.	00025
Location: North Stores	Name: NA	Date:	Analyst: Chris Barbor
Work Site: Ground Floor	Badge: NA	Dept.:	
Medical Number:	Date of injury: NA	Supervisor:	
		Problem / Complaint Description: Employee has been working in Data Processing for over ten years providing clerical support. She has a history of left and right wrist pain / paresthesias. Her job entails sorting data sheets for yardwide distribution. She is responsible for loading and removing feed from the Main frame printer. She carries the printed material to 33-inch high work tables where she sorts them by badge number. She also spends approximately 2-3 hours/day performing data input onto her PC.	
Amb. Temp: 72 dg F		Tools: Printer, PC	
Shift: 1st	Duration: 8 hrs	Light Level: variable	Requested by:
Job Analysis: Layout of the 'printer room'. A pallet stack of printer paper at the far end of the room. Pallets are loaded with 48 4-lb. boxes. Box dimensions are: 12x15x9 and weigh 40 lbs. each. Boxes are hand-carried 14 feet from pallet to printer.			
<p>(Third shift employee usually unloads the boxes onto a hand-cart that is then placed across from the printer. Since this is not always possible, the day-shift employees hand-carry boxes as needed when the cart is empty.)</p> <p>The boxes are dragged across the ridged floor and often catch between tiles. This causes jerking and increased force to be placed on the employee's back and upper extremities.</p> <p>The employee was instructed in proper lifting and carrying posture during our visit. When lifting paper boxes from the hand-cart, she must carry the load 31 inches to the printer and then place it onto the floor. She maneuvers the box over a lip on the floor of the printer and proceeds to feed the paper into the feeder-bar, using an electric control pad. There was poor illumination inside this area; 2 to 4 foot-candles were noted.</p>			
			
			
			



Ergonomic Assessment Work Site Evaluation

Bath Iron Works
A GENERAL DYNAMICS COMPANY

Survey No.

00025

Access to printer panels (where toner is added, oil changed, etc.) is obstructed by palletized loads and spare equipment. This creates further physical risk as the employee must move heavy materials. Repeated (and heavy) manual material handling increases the risk of muscle fatigue which can result in serious injury.

NOTE: Lifting Index + 1.4 at its origin and 1.98 at its destination. According to NIOSH Lifting guidelines an index over 1.0 is considered HAZARDOUS.

She spends 5 hours per day sorting and breaking down reports. This involves repetitive pinch grip




(Employee Name) sits at a computer workstation. She normally assumes this seated posture, with her leg crossed under her. The chair provides moderate support to her lumbar spine and she does change position frequently, but the chair is low. She sits with forward flexion (kyphotic posture).

She spends 2-3 hours per day on the computer terminal. Her viewing distance from the monitor is 21 inches (14-inch monitor). Table height is 29 inches and it accommodates an adjustable keyboard tray. Keyboard is at a positive tilt, placing her wrists in 10 degrees of extension. Ergo chair has a positive tilt preventing adequate lumbar support.

In general, illumination is poor. Employee keeps the overhead fluorescents 'off'. There is no task lighting. Noise levels vary and the office is climate-controlled.



***Note:** At the time of this visit there were only one and 1/2 employees performing this job on first shift; both on limitations.

	Ergonomic Assessment Work Site Evaluation		Bath Iron Works <small>A GENERAL DYNAMICS COMPANY</small>
	Survey No.	00025	
Repeated and sustained exertions:			
Upper extremity: 1. Repetitive pinch grip 2. Repetitive keying 3. Left cervical rotation >20 degrees for document viewing 4. 10 degree wrist extension with data entry Whole Body: 1. Lifting 40 lb boxes (approx. 15 boxes per 8hr shift) 2. Sitting for 2-3 hrs per day in an awkward posture.			
Mechanical /Contact Stresses:			
1. Extremely poor sitting posture 2. Obstructed access to laser printer for oil changes, toner, etc.			
Recommendations:			
1. Clear access to all parts of printer. Pallets of paper should be placed as close as possible to printer. Consider small mechanical lift to transfer and load paper into the printer. 2. Consider mechanical sorts vs. manual. By badge? By Dept? Consider engineering process solutions to minimize repetitive hand-sorting. 3. Employee instructed in proper posture at PC workstation and while performing material handling tasks. 4. Reduce positive keyboard tilt. 5. Employee advised to break-up tasks, pace herself, and take frequent rest / stretch breaks. 6. Adjust chair to provide adequate lumbar support.			
Summary:			
We will contact supervision in an effort to expedite the needed changes in this area. (Employee Name) continues to treat with BIW Physical Therapy Department. We will continue to follow-up as necessary.			
cc: Ergo File Worker's Comp File Medical File			

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Appendix C: Agenda for On-site Benchmarking Activity

Tuesday, August 17th

NASA Group

12:45 p.m.

Arrive at BIW Facility (Visitor Control)

Dan Nadeau

1:00 p.m.

- General Discussion with Executive Staff
 - General Overview
- (all afternoon meetings held in IBMP Conference Room)*

1:30 p.m.

- Manufacturing Process
- Statistical Indicators and Trends (lost time injury/illness rates)
- Goals and Objectives

Vince Dickinson

2:00 p.m.

- ISO 14001 – 18001 Program Elements (OSHA Compliance/Inspections)

2:45 p.m.

Break

Dan Nadeau

3:00 p.m.

- How we Manage Safety – Strengthening Accountability of Management/Employees
- Auditing Process
- Training/Awareness – Hazards and Risks
- Addressing Behavior
- Employee Involvement
- Control of Remote Sites

AGENDA – NASA Benchmarking Trip

Wednesday, August 18th

NASA Group

7:45 a.m.

Arrive at BIW Facility (Visitor Control)

Dan Nadeau

8:00 a.m.

- Shipyard/Ship tour

Laura Mathisen

10:00 a.m.

- Accident/Incident/Near Miss Investigation
(all meetings held in KPG Conference Room)

Dan Ferguson

11:00 a.m.

- Case Management

11:30 a.m.

Lunch Break

Maria Mazorra, M.D.

12:00 noon

- Ergonomics
- Stay at Work/Return to Work
- Physician Outreach
- Open Discussion

Maureen Kenney

1:00 p.m.

- Employer Health Coalition

Phyllis Wolfe

1:30 p.m.

- Wellness Programs

2:00 p.m.

Break

All

2:15

- Open Discussion
- Executive Outbrief

Appendix D: Benchmarking Preliminary Question Matrix and BIW Responses

Benchmarking Preliminary Question Matrix

Major Elements / Themes / Threads

	Industrial Safety	Environmental Management	Employee Wellness
Management / Organization	1. Organizational Structure 2. History / Overall Perspective 3. Organizational Objectives and Targets	1. Organizational Structure 2. History / Overall Perspective 3. Organizational Objectives and Targets	1. Organizational Structure 2. History / Overall Perspective 3. Organizational Objectives and Targets
Define Requirements <PLAN>	4. Policy & Planning 5. Governing Documents	4. Policy & Planning: 5. Governing Documents	
Implement Requirements: Processes Tools and Techniques <DO>	6. Training/Awareness 7. Hazard and Risk Identification 8. Work Processes:	6. Implementation & Operation: 7. Training/Awareness	4. Implementation & Operation: 5. Training/Awareness
Verify Implementation: Process Controls <CHECK>	9. Metrics: 10. Reviews /Audits 11. Lessons Learned 12. Mishap Investigation	8. Metrics: 9. Reviews /Audits 10. Lessons Learned: 11. Incident Resolution	6. Metrics: 7. Reviews /Audits
Certify Operational Readiness: Responsibility & Accountability Methods <ACT>	13. Certification Audits 14. Certification Review Processes	12. Certification Audits 13. Certification Review Processes	

BIW Responses

THEME I: INDUSTRIAL SAFETY

1. ORGANIZATIONAL STRUCTURE

Where does industrial safety responsibility lie? Provide a program management wiring diagram showing the organizational elements accountable for enabling the safety infrastructure.

The President has overall responsibility for environmental, health & safety management at BIW. The President authorizes department heads the responsibility, authority and accountability for EHS management for their areas of responsibility.

BIW's overall EHS MS organizational structure and responsibilities are illustrated in Figure 1-1. The major components of the management structure are described below.

EHS Management Representative

BIW has appointed the Director of Environmental, Health & Safety as the EHS Management Representative (EHS-MR). The EHS-MR has the responsibility to:

- Ensure that EHS management system requirements are established, implemented and maintained;
- Report on the performance of the EHS management system to the President and the EHS Steering Committee.

EHS Steering Committee

The Vice-President, Human Resources chairs the EHS steering committee. The Committee consists of the following:

- EHS Management Representative;
- Vice President, Manufacturing & QA;
- Vice President, General Counsel;
- Vice President, Planning & Support;
- Vice President, Programs, Strategic Planning and Communications;
- Vice President, Engineering & Procurement;
- Vice President, Finance, Administration & IS/IT;
- Vice President, LCS Program

Environmental, Health & Safety Division

The EHS Division consists of four managers and accompanying staff responsible for planning and implementing programs that minimize or prevent EHS impacts to BIW operations.

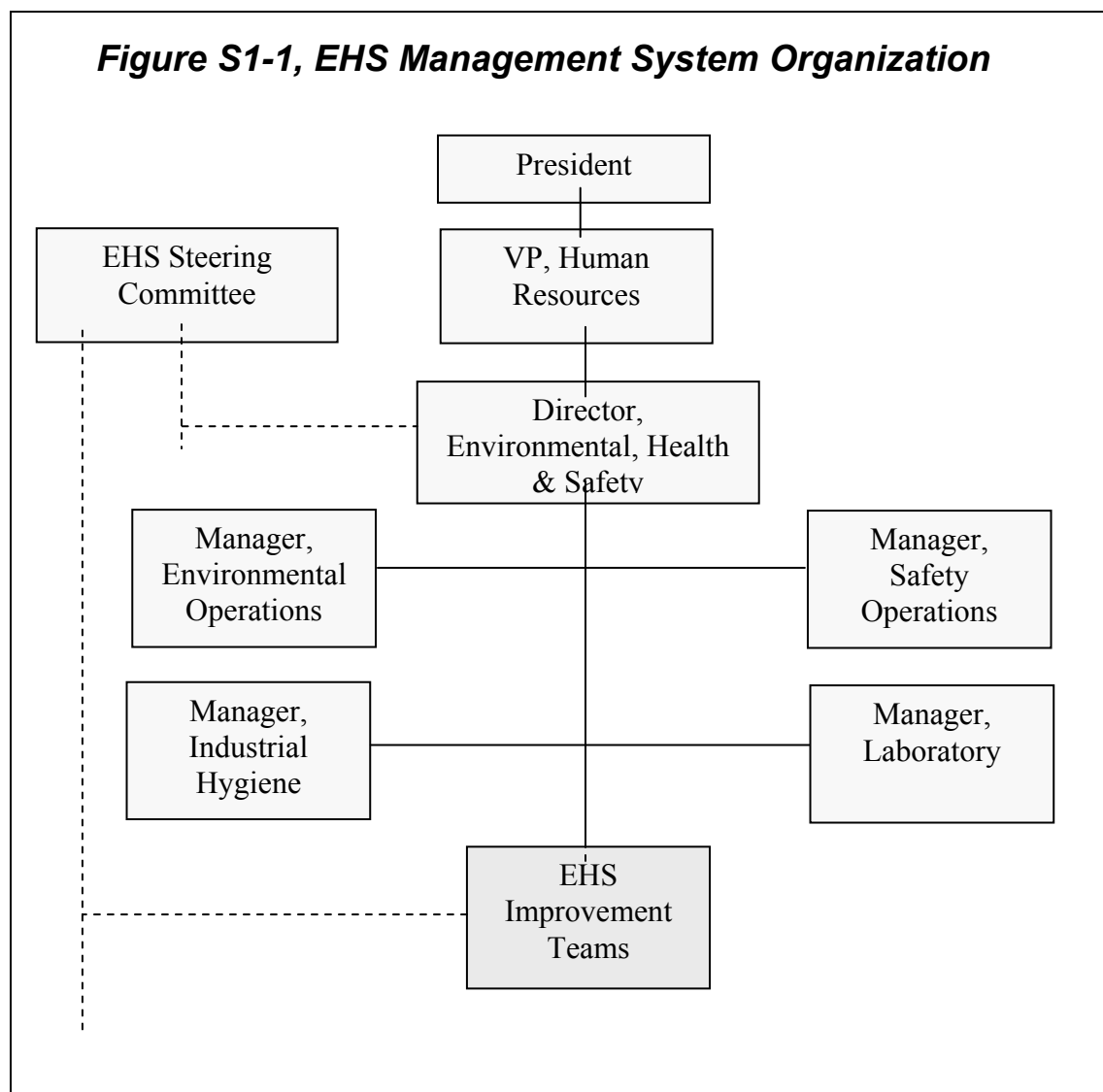
NASA Questionnaire Matrix – Theme I: Industrial Safety Management / Organization

ADHOC Improvement Teams

ADHOC EHS Improvement Teams are assigned responsibility for implementing EHS Improvement Plans.

Specific Responsibilities

Roles and responsibilities for specific elements of the EHS Management are identified and documented in each specific Environmental, Health & Safety Procedure (EHSP).



NASA Questionnaire Matrix – Theme I: Industrial Safety Management / Organization

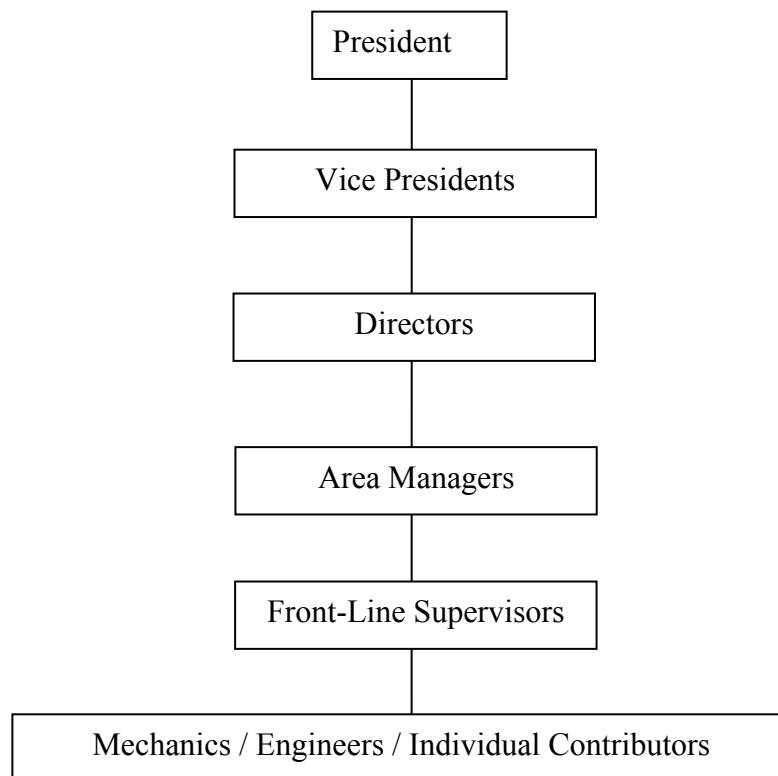
What are the various levels of management and how are responsibilities allocated (departments / projects / managers / workers)?

What are the safety relationships within the organization, and where are the responsibilities for safety documented?

Levels of Management & Responsibilities

The generic management structure of BIW is depicted in Figure 1-2 below. All levels of management are responsible for ensuring compliance with BIW's Environmental, Health & Safety Management System. Specific EHS responsibilities are documented within Environmental, Health & Safety Procedures (EHSP's) and various Operational Control Documents. Every employee is responsible for complying with company rules and procedures for EHS.

Figure S1-2, Generic Management Structure



NASA Questionnaire Matrix – Theme I: Industrial Safety Management / Organization

Safety Relationships

Union Safety Committees

In addition to the individual responsibilities of management and individual employees, each of the four bargaining units has “Union Safety Committees” to address EHS concerns of their respective members.

Management Safety Committees

Likewise, Management has established a Central Safety Committee, chaired by the VP of Manufacturing, to address ADHOC issues and serve as a steering organization for various Area Safety Committees.

2. HISTORY / OVERALL PERSPECTIVE

Describe the history/evolution of the BIW industrial safety program

The origins of BIW’s Safety program are rooted with the establishment of a Chemical and Metallurgical Testing Laboratory during World War II. In the early sixties the Laboratory started to do industrial hygiene and environmental testing and it became known as the Technical and Environmental Laboratory.

In the mid - sixties, BIW started in the overhaul and repair business. This was a new type of work and involved "ripping-out" material on ships and replacement with new. It also meant that some type of control over all types of hot work, such as welding, burning, flame straightening, riveting, brazing and grinding, would have to be instituted as required by Navy specification and standard items. The job was given to the Laboratory. The Lab was responsible for approving hot work on these ships. In 1966 a Competent Person Program was instituted. This required the hiring of additional personnel. Personnel were trained by the Marine Chemist as Competent Persons and their appointment had to be confirmed by a Company Officer - usually a vice - president. The Competent Persons acted as the "eyes and ears" of the Marine Chemist. All hot work jobs had to have the approval of a CP who would inspect the job site and determine if it was safe to perform the work. This program was and continues to be considered the “model program” throughout the industry.

Because the ships being repaired had pipe covering that contained asbestos, the Laboratory also got into the Industrial Hygiene and Environmental business. Procedures for the removal and handling of asbestos were developed and written by the Laboratory. The Laboratory in conjunction with the Harvard School of Public Health devised a method of identifying asbestos fibers and determining their airborne concentration. These methods are still in use today.

NASA Questionnaire Matrix – Theme I: Industrial Safety Management / Organization

By the early 1980s, the Laboratory was handling Material Safety Data Sheets and supporting the removal of asbestos, mercury, PCB's and lead paint from a refurbished drydock and hot work control.

The modern era of BIW's EHS program began in 1987 when OSHA conducted a Wall-to-Wall inspection and BIW received, what was at the time, the largest proposed penalty in OSHA history, \$4.1M. At this time the first Director of Environmental, Health & Safety was hired and tasked with ensuring BIW had adequate programs to manage EHS issues. The Laboratory became part of this division and two new departments were created: Safety & Health and Environmental.

In 2000, BIW recognized the need to change the behaviors and culture of all employees, management and mechanics, regarding safety. Over the next 12-month period a 3-pronged approach was developed to achieve this goal.

The first prong was to work collaboratively with OSHA to resolve its safety issues. A partnership agreement was signed with OSHA on March 27, 2002. This agreement set BIW on the path to work with its employees and regulatory agencies to improve safety.

The second prong, based in part on feedback from OSHA and the Unions, was an extensive program to change the safety culture of management. DuPont Safety Resources was hired as a consultant to work with all levels of Management on total safety ownership. The ultimate goal of this program is to change the behavior of all employees with regards to safety and to have all levels of management embrace and 'own' safety. All levels of Management were trained on the DuPont methodology, auditing, in 2003.

The third prong was to standardize our procedures and processes into a proven and recognized system. In 2002, BIW began formalizing its Environmental, Health & Safety Management System. In February 2004, BIW became the first shipyard in the country to be both ISO 14001 Certified and OHSAS 18001 Compliant.

In what areas has BIW been particularly effective?

Following are some key areas where our current program has been particularly effective:

- BIW has been particularly effective identifying risks and developing processes and procedures to eliminate or control those risks.
- Ensuring that new employees are adequately trained has been very successful and well received. This is accomplished through our New Employee Orientation program.
- Measuring injury performance by production area and supervisor to increase accountability.

NASA Questionnaire Matrix – Theme I: Industrial Safety Management / Organization

- Specialized 8-Hour Training course on EHS management was provided to every supervisor.
- Involving all levels of management in safety auditing and injury investigations.
- Weekly “Safety Talk / Scenario Talk” awareness program. This is a weekly deck-plate meeting held by Supervision with mechanics. Information from the EHS Division is provided to the Supervisors for presentation to crews.
- The Safety/Environmental Alert process is very effective in getting alerts about unsafe conditions or issues out to the workforce in an expedited manner.

What are some of the success stories for BIW industrial safety?

- Reducing Loss Time Accidents by 42% over the past 5 years and reducing Recordable Injuries by 40% over the past 5 years.
- Changing our relationship with OSHA through the partnership.
- Our outreach efforts through participation in various groups (MACOSH, NSRP, Marine Chemists Association, EPA/DEP Working Groups) have allowed us to increase our influence on the development of regulatory and industry issues, and allowed us to be very proactive in dealing with these changes.
- Having our EHS Management System certified to ISO 14001 and OHSAS 18001.
- BIW’s Confined Space Program. We have not had a single confined space death in the 40+ years of the program.
- BIW’s Hot Work Control Program. We have had no explosions or serious accidents associated with hot work in the 40+ years of the program.
- Promoting Management to take a leading role in Safety, including conducting audits and injury investigations, and forming task forces to address emergent issues.

3. ORGANIZATIONAL OBJECTIVES & TARGETS

What organizational goals/targets have been established with respect to industrial safety?

Overall Objective

Become the Safest Shipyard in the United States by 2005.

Interim Targets

Reduce the total number of injuries by 29% per year in 2003, 2004 and 2005.

2004 Focus Areas

Reduce injuries and risks in the following areas:

- Electrical Shock
- Falls
- Upper extremities
- Backs

Is BIW currently OHSAS 18001 certified?

YES

What challenges have been faced with regard to OHSAS 18001 certification?

There have been several challenges with regards to OHSAS 18001. The first was how to effectively integrate the program into existing culture and processes so that it was not perceived as a “new” paper program. BIW already had existing EHS control documents and ISO 9000 work instructions. The challenge became incorporating those existing and accepted documents into the overall management system.

A second challenge has been how to effectively communicate the EHS Policy. The policy has been distributed and discussed through a variety of means, but retention of the content of the Policy is still low.

During implementation we struggled with defining EHS monitoring equipment. This equipment requires maintenance and calibration.

4. POLICY & PLANNING

Has BIW encountered any organizational culture issues/challenges in establishing and maintaining an industrial safety program?

The most significant organizational culture challenge has been getting people to embrace personal accountability for EHS issues. Oftentimes, EHS is seen as the EHS Division's issue or responsibility.

This translates through the entire line organization. Mechanics often do not take personal responsibility for EHS. For example, a common response from a mechanic not wearing proper PPE is that their supervisor did not tell them to wear it. This is despite extensive training on PPE requirements and oftentimes acknowledgement by the employee of the requirement. Additionally, some supervisors still view 'safety' as the job of the Safety Department.

5. GOVERNING DOCUMENTS

Describe the governing safety policies and procedures documents applicable to the BIW industrial safety program.

BIW has an Environmental, Health & Safety Management System Manual that identifies the core elements of the EHSMS. BIW utilizes a hierarchical system of related documentation as shown in Figure S5-1 below. The categories of documents are as follows:

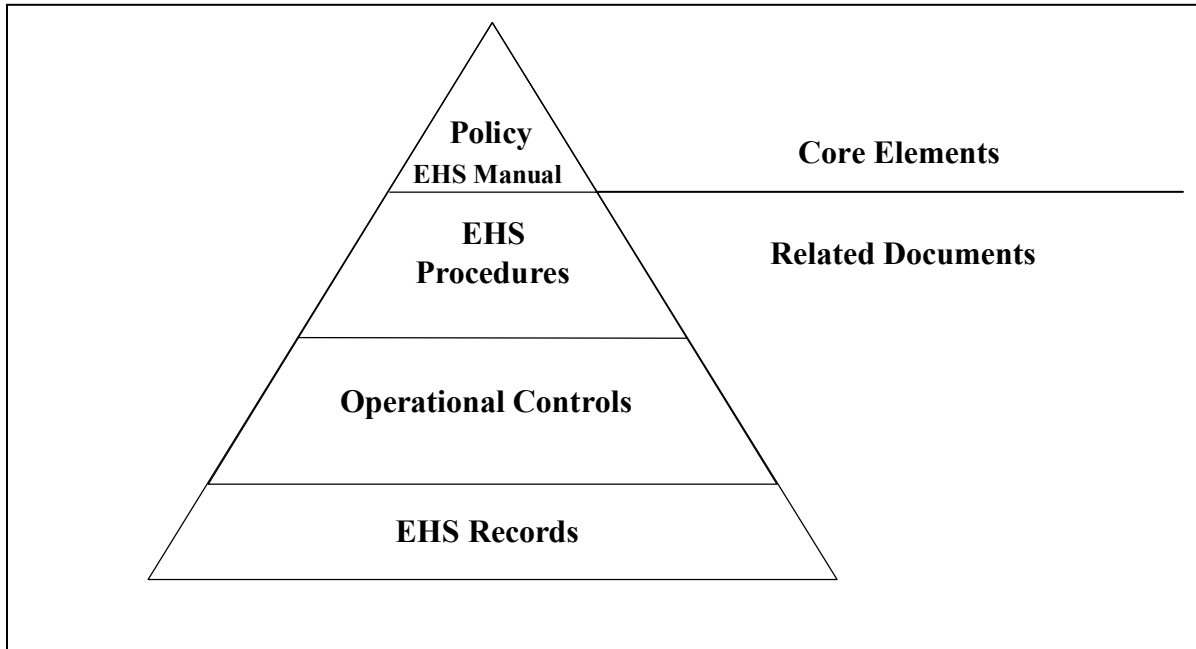
EHS Management System Manual – describes the core elements of the EHSMS in accordance with ISO 14001 and OHSAS 18001.

Environmental, Health & Safety Procedures (EHSP's) - are the procedures referenced in the EHS Manual that contain detailed information on specific parts of the EHSMS. Appendix B contains a listing of these procedures.

Operational Controls – are related documents that provide instructions to ensure significant aspects and risks are controlled when appropriate.

EHS records – are related documents that provide evidence that the EHSMS activities are being implemented as required.

Figure S5-1, EHSMS Documentation Matrix



EHS Management System Manual – describes the core elements of the EHSMS in accordance with ISO 14001 and OHSAS 18001.

Environmental, Health & Safety Procedures (EHSP's) - are the procedures referenced in the EHS Manual that contain detailed information on specific parts of the EHSMS. Appendix B contains a listing of these procedures.

Operational Controls – are related documents that provide instructions to ensure significant aspects and risks are controlled when appropriate.

EHS records – are related documents that provide evidence that the EHSMS activities are being implemented as required.

Appendix A contains a list of the Environmental, Health & Safety Procedures and Appendix B contains a list of the “SPM’s.”

Are there any additional requirements/incentive levied by the Department of the Navy?

Our contracts with the Navy invoke various EHS requirements into the contracts. In addition, overhaul work requires conformance to the Navy Standard Items, which include EHS requirements.

NASA Questionnaire Matrix – Theme I: Industrial Safety
Define Requirements <PLAN>

Are there any programmatic incentives related to safety?

The Navy does not have incentives for EHS performance, but there are contractual requirements to have specific programs in place to control EHS risks and to comply with various laws.

The current Labor Agreement limits types of recognition to only recognizing the entire company or section for company achievement; personal achievement cannot be recognized.

Has BIW pursued cooperative programs such as Voluntary Protection Programs (VPP)?

BIW has signed a letter of intent to pursue VPP. We are currently working with OSHA, as part of our partnership agreement, to seek VPP.

NASA Questionnaire Matrix – Theme I: Industrial Safety Implement Requirements <DO>

6. TRAINING / AWARENESS

How often do employees receive industrial safety-related training?
--

What methods are used to train employees for industrial safety?

EHS training is provided at various frequencies and consist primarily of four types of training.

New Employee Orientation training is provided upon the employee’s first day of work at BIW.

“Safety” Talks are provided every week. These are brief 15-minute sessions on safety that occur every week of the year.

Specialized Training is typically provided on a less frequent basis as determined by regulations, contracts or risk analysis. A few examples of typical specialized training may include training on specific equipment operation, fire-fighting, video display training, ergonomics, confined space rescue, emergency responder, hazardous waste management, respirator training, crane certification, welding, etc. This type of training is typically conducted on an annual basis, but may also occur more or less frequently as dictated.

On-The-Job Training is a critical part of any new or re-assigned employee training.

Does BIW utilize any employee incentive programs related to safety?

BIW periodically hosts special events to raise safety awareness, including hosting barbecue’s for Areas with outstanding Safety performance. In addition, BIW holds a Company-wide event on worker Memorial Day (April 28) each year to highlight safety. The event includes speakers from the Navy, OSHA and Senior Management.

7. HAZARD AND RISK IDENTIFICATION

How are potential workplace hazards identified?

BIW maintains procedures (EHSP-02-1, Identification of Environmental Aspects, EHSP-02-2, Identification of Health and Safety Risks and EHSP-02-3, Environmental, Health and Safety Review of Projects and Process Change) that detail the methods used in identifying and evaluating the environmental aspects and safety & health risks of its activities, products and services that it can control and over which it can be expected to have influence. This process supports efforts to put programs in place, which will reasonably minimize or prevent negative impacts or intolerable risks.

This evaluation ensures that the significant aspects and intolerable risks are considered in setting environmental, health & safety objectives and targets.

Summary of Risk Analysis Process:

- Safety Operations, Industrial Hygiene, and the Technical Laboratory evaluate specific tasks from the Trade Task Lists, as well as processes for potential health and safety risks.
- Risks and probability are researched utilizing available data including injury records, accident investigations, near hits, or evaluation of the task or process.
- Affected employees and Union Safety Committee members will review the hazard assessments.
- Significant risks are those hazards that received a value equal to or greater than 8 during the task evaluation process. In determining the probability and severity values the following attributes are taken into consideration:
 - The hazard affects multiple trades; and or
 - The hazard affects a large number of employees; and or
 - The hazard has a specified legal requirement, or a company policy, focus, or commitment; and or
 - The hazard is related to workers compensation cost; and or
 - Professional judgement based on industry activity and BIW history; and or
 - Existing control effectiveness.
- Contractors, subcontractors, and visitor assessments are handled case by case.
- Supervisors are assumed to have the same risks as those mechanics they supervise.

**NASA Questionnaire Matrix – Theme I: Industrial Safety
Implement Requirements <DO>**

How can employees report potential hazards?

The preferred method for reporting a potential hazard is for any employee to secure the area and report it directly to his/her supervisor.

BIW has also established a Safety Resolution Process for any employee wishing to raise environmental, health and safety concerns or who does not feel concerns are properly addressed. This process is documented on the back of the employee's badge.

Calls received on the Safety Resolution Line (X4777) are documented in a Log Book maintained by Safety Operations.

In addition, Safety Committees exist for each labor union and meet on a regular basis with management and Safety and Health representatives to exchange information and resolve safety and health issues.

What methods have been employed to protect 'whistle blowers'?

General Dynamic "Standards of Business Ethics and Conduct" clearly protects any employee of General Dynamics who brings an ethics or compliance concern forward from retaliation.

Describe the processes involved to resolve an identified potential hazard.

Once a potential hazard is identified employees are encouraged via the Safety Resolution Process to take the following steps:

- 1) Recognize the severity of the problem. Stop all work if an imminent hazard is present. If possible, and within your job description, try to resolve the problem.
- 2) If you need help contact:
 - a) Safety Inspector
 - b) Any Supervisor
- 3) If situation cannot be resolved, contact Union Safety Committee
- 4) Call Safety Resolution Line. Duty Safety Engineer will contact appropriate Union president to affect resolving issue.

**NASA Questionnaire Matrix – Theme I: Industrial Safety
Implement Requirements <DO>**

Are there particular operations/processes at BIW that are particularly hazardous?

Table S7-1 lists the Significant Risks for work performed at BIW. The actual occurrence of that risk as well as the degree of risk varies on a task-by-task basis.

Table S7-1, Significant Risks

Asphyxiation	Noise
Chemical Contact	Pinch/Nip Point
Chemical Inhalation	Projectiles
Ergonomics	Radiation
Explosion	Shock
Falls	Struck Against
Fires	Struck By
Injection	Thermal Stress
Laceration	Tip/Roll Over
Mechanical Failure	Work Environment

8. WORK PROCESSES

Are work procedures specifically reviewed for safety consideration?

How are work procedures documented?

Any company document can be utilized as an Environmental Health and Safety operational control. These include SPMs (EHS work instructions), DOIs (Quality work instructions), Maintenance PM's, Work Instructions, Environmental Permits, I&A's and vendor contracts.

EHSP's and SPM's are specifically designed for EHS control and are written to be overarching EHS requirements. When deemed appropriate by the issuing department or EHS Division, other company documents may include EHS considerations. Typically this will be task-specific detailed information which expands upon requirements already outlined in SPM's.

BIW has a procedure "EHSP-06-1, EHS Document Control" that outlines the documents used for EHS management.

**NASA Questionnaire Matrix – Theme I: Industrial Safety
Implement Requirements <DO>**

What methods are used to identify work procedures in need of updating?

What is the process for updating a work procedure?

Each department assigned responsibility for an EHS document is responsible for periodically reviewing and updating work procedures. In the case of EHSP's and SPM's the EHS Division reviews all of these procedures on an annual basis. Quality Procedures (QP's DOI's and Work Instructions) are reviewed as part of the ISO 9001 internal audit program.

We have developed a Change Management Procedure, with a simple checklist tool for use by various departments. A "Yes" answer to any question is an indicator to involve the EHS division. The EHS division assists with identifying needed procedural changes.

Who has signature responsibility for procedures (including new procedures and updates)?

The most appropriate level of Management with direct control over a procedure has signatory responsibility. The intent is to have the lowest practical level of management with signatory approval. Depending on the procedure this could be the CEO, VP, Director or Manager level. For example, a procedure whose control resides within the areas of a few Directors would be signed by those Directors, versus the VP of that area. If the procedure is applicable across that entire organization the VP would sign.

How are employees trained to respond to a work procedure or task which they deem unsafe?

Reference "Safety Resolution Process" in section 7 above.

How does BIW balance schedule pressures with safety concerns?

This always remains a constant challenge. Our approach is to engage Management and the workforce on a daily basis, to emphasize the importance of EHS. This is accomplished by having daily discussion on injury metrics, Safety Talks, management audits, EHS Division Audits, and constantly reinforcing safety expectations.

In addition, any employee has the ability to shut down a job or refuse to do work they deem to be unsafe. We have a consistent record of embracing this philosophy.

NASA Questionnaire Matrix – Theme I: Industrial Safety
Verify Implementation <CHECK>

9. METRICS

What industrial safety metrics are tracked?

How often are metrics recorded and reported?

To whom are metrics reported?

Table S9-1 below contains a summary of the type of metrics maintained the frequency and the parties receiving the data.

Table E9-1, Safety Metrics

Type of Metric	Frequency	Deliverable
Universal Safety Audit	Weekly	Manuf VP/Directors
Days w/o Lost Time Report	Weekly	Manuf VP/Directors
Lost Time (frequency/severity)	Weekly	Manuf VP/Directors
Safety Talk Performance	Weekly	Manuf VP/Directors
Shift Comparison Matrix	Weekly	Manuf VP/Directors
Area Statistical Packages (assembly)	Weekly	Manuf VP/Directors
IIR Performance Report	Weekly	Manuf VP/Directors
Daily Injury Notice Log (F,M, I, LT)	Daily	All Supervision
Area Supervisor Matrix	Weekly	Area Supervisors
FLS REC/LT Injury Report (Ranking)	Monthly	Manuf VP/Directors
End of Month Statistics (Senior Management Report)	Monthly	Senior Management/Directors
Weekly Statistics (actual vs. limits)	Weekly	All Supervision
Field Guide	Monthly	Senior Management/Directors
End of Month Detailed Trade Analysis	Monthly	Manuf VP/Directors
Multi Injury Employee Report	Weekly	Manuf VP/Directors

NASA Questionnaire Matrix – Theme I: Industrial Safety
Verify Implementation <CHECK>

10. REVIEWS / AUDITS

What reviews/audits are conducted to verify industrial safety compliance?

How often are reviews/audits conducted?

Who participates in the reviews/audits?

Table S10-1 below contains information on EHS Audits;

Table S10-1, EHS Audits

Audit Type	Frequency	Whom
EHS Management System	Monthly	EHS Staff
Safety Inspections	Daily	EHS Staff
Scheduled inspections or audits	Varies according to schedule	Represented EHS Staff
Wall-to-Wall	Monthly	EHS Staff, Production, Maintenance
Behavior Audits	Weekly	All Management

In addition, BIW conducts EHS Management System Management Reviews with senior Management every 6 months.

11. LESSONS LEARNED

How and where are lessons learned captured?

Lessons learned are captured during incident investigations, drills and training exercises.

How are past lessons learned transferred to new programs/work processes/other facilities?

Appropriate corrective action is initiated as a result of incident investigations, drills or exercises. Corrective actions ensure that lessons are incorporated into other areas of the company and/or into procedures.

Another effective way to quickly communicate lessons learned is through the “Scenario Talk” process. A Scenario Talk is a Safety Talk that goes out as part of the Safety Talk Weekly Package that contains a summary of a real event, such as significant spill or releases. The Talk covers what happened and what went wrong, including the root cause and any new procedural changes that may have resulted.

11. INCIDENT RESOLUTION

What types of incidents are reported?

How are these incidents reported?

BIW has a procedure detailing when incidents must be reported. Serious accidents and serious incidents, as defined below, must be reported.

Serious Accident - any accident which results in death, hospitalization (admitted as in-patient), or severe trauma (amputation, second/third degree burns, fractures, loss of consciousness, respiratory disorders, severe lacerations, avulsions, crushing injuries, severe contact with electricity, etc.) to any person(s) on BIW property.

Serious Incident - any chain of events that result in a mishap which could have caused a serious accident, or events that result in the loss of property to BIW, subcontractors, Supervisor of Shipbuilding or any customer.

In addition, supervisors are responsible for completing root cause reports for any employee injured at BIW.

What steps are involved in a mishap investigation?

All facts of the incident are collected through physical inspection, interviews with employees directly involved or witness to the incident, and review of relevant records or other applicable data.

Describe your closed-loop corrective action process

EHS personnel identify nonconformities for the need for corrective action. Actions are assigned to the function(s) responsible for the nonconformance to correct them through one of the methods below.

Universal Data Collection Form (UDCF)

- UDCF's are issued by the EHS division to address short-term issues and are implemented by the appropriate function(s). These forms ensure complete closure of slips.
- UDCF's are tracked through completion and documented. Exception reports are generated and monitored to ensure all slips are closed.

Accident/Incident Investigation Reports

- Accident/Incident Investigation Reports are prepared by the EHS professional staff.
- Actions are documented within the Reports and are completed by the assigned function. Actions are tracked by the investigating engineer and remain open until completion.

“Safety / Environmental” Maintenance Work Order

- Work Orders are requested by any employee and implemented by the Facilities Division.
- Work Orders are tracked through the Maintenance Management System.

EHS Action Database

Actions that are not tracked through the above methods are entered into a database maintained by the EHS division and tracked through closure.

How are remote sites controlled/related to the BIW program?

All BIW Rules and Procedures apply to remote sites and for BIW employees working at a non-BIW site.

13. CERTIFICATION AUDITS

What are the processes for verifying industrial safety compliance throughout facility operations?

In addition to the audits identified in Table S10-1, EHS Audits, BIW has two surveillance audits per year of our EHS Management System conducted by a certified Registrar.

14. CERTIFICATION REVIEW PROCESS

Describe the processes that enable/provide management knowledge and understanding of industrial safety issues.

EHS Management reviews are conducted every 6 months or more frequently as determined by Top Management. The EHS Division prepares the necessary information for Top Management to evaluate the system. Top Management reviews the information presented about the EHS Policy, Significant Aspects/Risks, Objectives and Targets, Internal Audit Findings and other relevant data. The information is used to evaluate and understand the effectiveness and continuing suitability of the EHS management system and issues associated with it.

In addition metrics are provided to management on a routine basis, as are weekly “highlights.”

Describe how Objective Quality Evidence (OQE) is gathered and documented to demonstrate safety processes are fully implemented.

What oversight or audits are used to verify the quality and technical adequacy of industrial safety implementation?

Both internal and external sources are used to provide objective evidence and to verify the quality of the EHS program.

External Data such as, Customer Feedback, NOV’s / Citations, Registrar Findings, Public Complaints, Corporate Review findings.

Internal Data such as, Accident/ Incident Reports, Universal Data Collection Results, EHS Work Order Status, Performance on Action Plans and various performance metrics are utilized to monitor objectives and targets as well as other elements of the EHS Management System.

NASA Questionnaire Matrix – Theme I: Industrial Safety
Certify Operational Readiness <ACT>

What manufacturing and support equipment is required to maintain safety certification?

Numerous types of equipment are needed to ensure safe operations and that employees are protected. These include respirators, PPE, monitoring equipment, equipment guards, fall protection, etc. In order to manage risk, considerable equipment is required and therefore is necessary to maintain certification.

How often is re-certification required?

The EHS Management System is re-certified every 3 years.

What methods are used to inspect and certify safety-related equipment?

Critical EHS equipment has been identified in the Maintenance Management System to ensure it is routinely inspected and maintained. In addition, relevant EHS monitoring equipment is tracked in the Calibration Database to ensure calibration is maintained.

THEME II: ENVIRONMENTAL HEALTH

1. HISTORY / OVERALL PERSPECTIVE

Where does environmental management responsibility lie? Provide a program management wiring diagram showing the organizational elements accountable for enabling the safety infrastructure.

The President has overall responsibility for environmental, health & safety management at BIW. The President authorizes department heads the responsibility, authority and accountability for EHS management for their areas of responsibility.

BIW's overall EHS MS organizational structure and responsibilities are illustrated in Figure 1-1. The major components of the management structure are described below.

EHS Management Representative

BIW has appointed the Director of Environmental, Health & Safety as the EHS Management Representative (EHS-MR). The EHS-MR has the responsibility to:

- Ensure that EHS management system requirements are established, implemented and maintained;
- Report on the performance of the EHS management system to the President and the EHS Steering Committee.

EHS Steering Committee

The Vice-President, Human Resources chairs the EHS steering committee. The Committee consists of the following:

- EHS Management Representative;
- Vice President, Manufacturing & QA;
- Vice President, General Counsel;
- Vice President, Planning & Support;
- Vice President, Programs, Strategic Planning and Communications;
- Vice President, Engineering & Procurement;
- Vice President, Finance, Administration & IS/IT;
- Vice President, LCS Program

Environmental, Health & Safety Division

The EHS Division consists of four managers and accompanying staff responsible for planning and implementing programs that minimize or prevent EHS impacts to BIW operations.

NASA Questionnaire Matrix – Theme II: Environmental Management Management / Organization

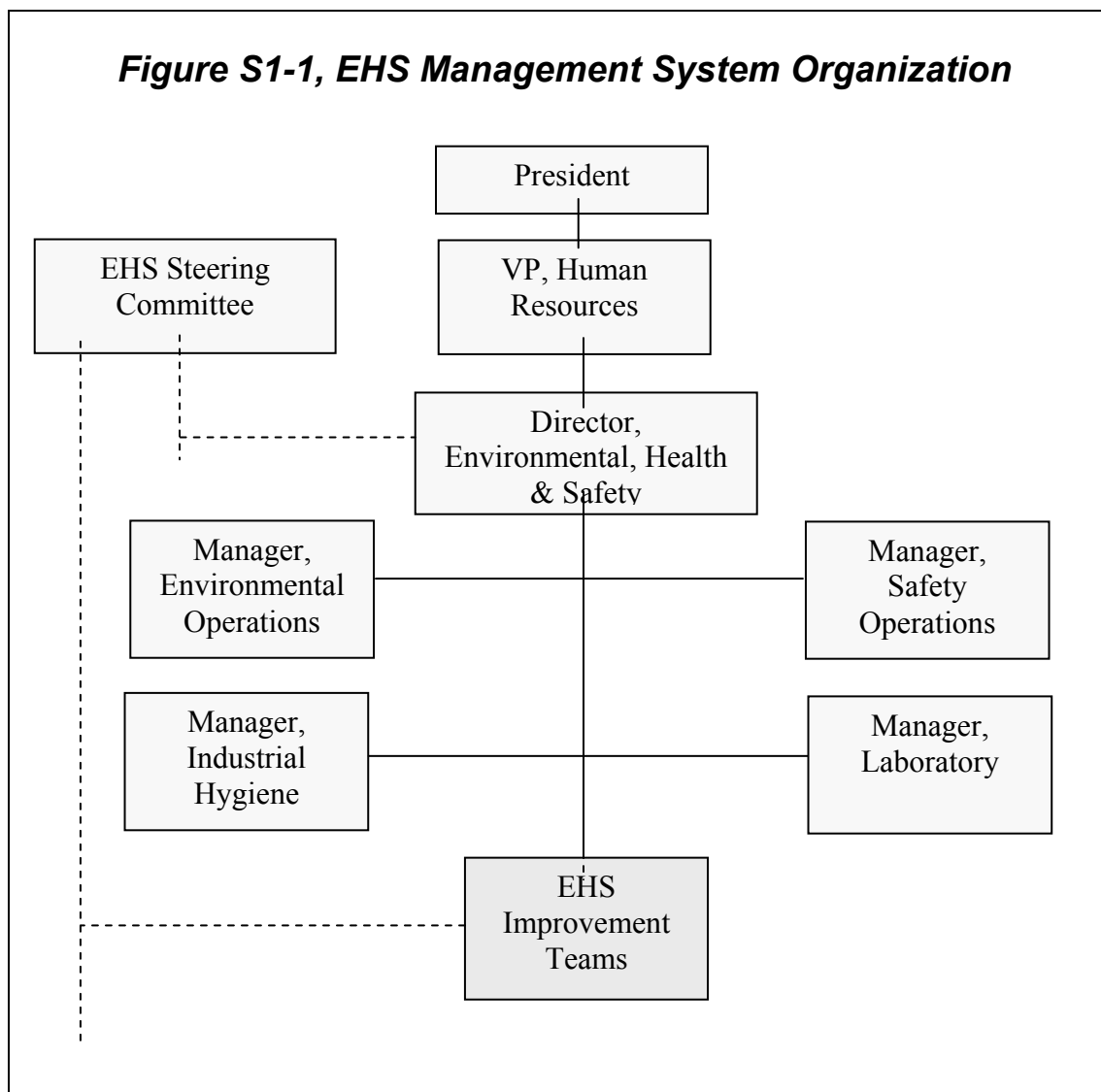
ADHOC Improvement Teams

ADHOC EHS Improvement Teams are assigned responsibility for implementing EHS Improvement Plans.

Specific Responsibilities

Roles and responsibilities for specific elements of the EHS Management are identified and documented in each specific Environmental, Health & Safety Procedure (EHSP).

Figure S1-1, EHS Management System Organization



NASA Questionnaire Matrix – Theme II: Environmental Management Management / Organization

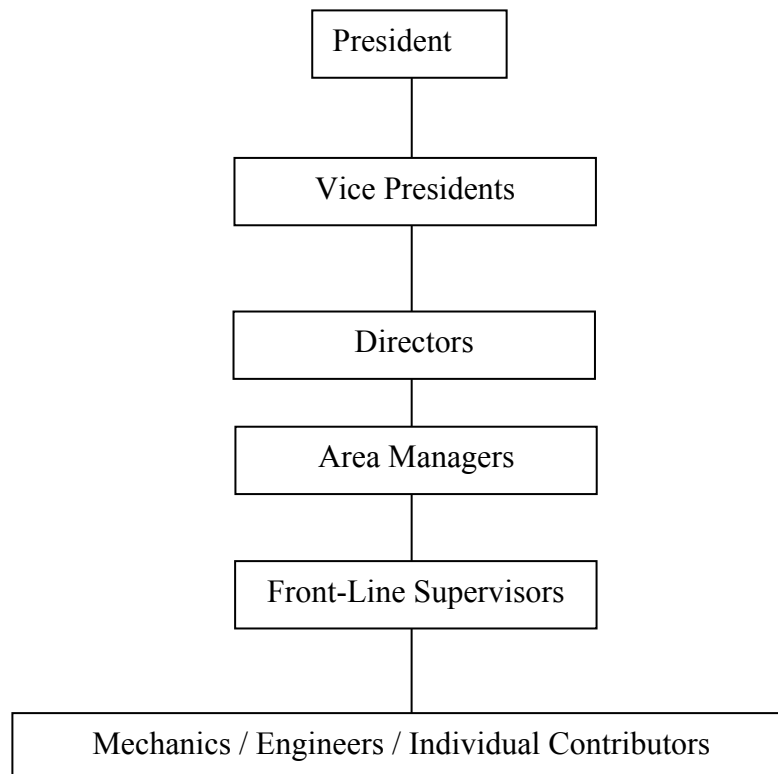
What are the various levels of management and how are responsibilities allocated (departments / projects / managers / workers)?

What are the environmental management relationships within the organization, and where are the responsibilities for safety documented?

Levels of Management & Responsibilities

The generic management structure of BIW is depicted in Figure 1-2 below. All levels of management are responsible for ensuring compliance with BIW's Environmental, Health & Safety Management System. Specific EHS responsibilities are documented within Environmental, Health & Safety Procedures (EHSP's) and various Operational Control Documents. Every employee is responsible for complying with company rules and procedures for EHS.

Figure S1-2, Generic Management Structure



NASA Questionnaire Matrix – Theme II: Environmental Management Management / Organization

Environmental Relationships

Union Safety Committees

In addition to the individual responsibilities of management and individual employees, each of the four bargaining units has “Union Safety Committees” to address EHS concerns of their respective members.

Management Safety Committees

Likewise, Management has established a Central Safety Committee, chaired by the VP of Manufacturing, to address ADHOC issues and serve as a steering organization for various Area Safety Committees. This committee also addresses environmental issues as they arise.

2. HISTORY / OVERALL PERSPECTIVE

Describe the history/evolution of the BIW industrial safety program

The origins of BIW’s environmental program are rooted with the establishment of a Chemical and Metallurgical Testing Laboratory during World War II. In the early sixties the Laboratory started to do industrial hygiene and environmental testing and it became known as the Technical and Environmental Laboratory.

In the mid - sixties, BIW started in the overhaul and repair business. This was a new type of work and involved "ripping-out" material on ships and replacement with new. It also meant that some type of control over all types of hot work, such as welding, burning, flame straightening, riveting, brazing and grinding, would have to be instituted as required by Navy specification and standard items. The job was given to the Laboratory. The Lab was responsible for approving hot work on these ships. In 1966 a Competent Person Program was instituted. This required the hiring of additional personnel. Personnel were trained by the Marine Chemist as Competent Persons and their appointment had to be confirmed by a Company Officer - usually a vice-president. The Competent Persons acted as the "eyes and ears" of the Marine Chemist. All hot work jobs had to have the approval of a CP who would inspect the job site and determine if it was safe to perform the work. This program was and continues to be considered the “model program” throughout the industry.

Because the ships being repaired had pipe covering that contained asbestos, the Laboratory also got into the Industrial Hygiene and Environmental business. Procedures for the removal and handling of asbestos were developed and written by the Laboratory. The Laboratory, in conjunction with the Harvard School of Public Health, devised a

NASA Questionnaire Matrix – Theme II: Environmental Management Management / Organization

method of identifying asbestos fibers and determining their airborne concentration. These methods are still in use today.

By the early 1980's, the Laboratory was handling Material Safety Data Sheets, supporting the removal of asbestos, mercury, PCB's and lead paint from a refurbished drydock and hot work control.

The modern era of BIW's EHS program began in 1987 when OSHA conducted a Wall-to-Wall inspection and BIW received, what was at the time, the largest proposed penalty in OSHA history, \$4.1M. At this time the first Director of Environmental, Health & Safety was hired and tasked with ensuring that BIW had adequate programs to manage EHS issues. The Laboratory became part of this division and two new departments were created: Safety & Health and Environmental.

In 2000, BIW began recognized the need to change the behaviors and culture of all employees, management and mechanics regarding safety. Over the next 12-month period a 3-pronged approach was developed to achieve this goal.

The first prong was to work collaboratively with all regulatory agencies on issues. In July 2002, BIW became an inaugural member of the Maine Department of Environmental Protections STEP-UP Program, a collaborative partnership program between top performing companies and the DEP. In addition, BIW (along with several shipyards) joined EPA's Sustainable Industries Program. Under this program BIW volunteered to complete EPA's Shipbuilding EMS Project.

The second prong, based in part on feedback from OSHA and the Unions, was an extensive program to change the safety culture of management. DuPont Safety Resources was hired as a consultant to work with all levels of Management on total safety ownership. The ultimate goal of this program is to change the behavior of all employees with regard to safety and to have all levels of management embrace and 'own' safety. All levels of Management were trained on the DuPont methodology, auditing, in 2003.

The third prong was to standardize our procedures and processes into a proven and recognized system. In 2002, BIW began formalizing its Environmental, Health & Safety Management System. In February 2004, BIW became the first shipyard in the country to be both ISO 14001 Certified and OHSAS 18001 Compliant.

In what areas has BIW been particularly effective?

Following are some key areas where our current program has been particularly effective:

NASA Questionnaire Matrix – Theme II: Environmental Management Management / Organization

- BIW has been particularly effective in identifying environmental risks and developing processes and procedures to eliminate or control those risks.
- Ensuring that new employees are adequately trained has been very successful and well received. This is accomplished through our New Employee Orientation program.
- Measuring environmental performance to increase accountability.
- Specialized 8-Hour Training course on EHS management was provided to every supervisor.
- Weekly “Safety Talk / Scenario Talk” awareness program. This is a weekly deck-plate meeting held by Supervision with mechanics. Information from the EHS Division is provided to the Supervisors for presentation to crews.
- The Safety/Environmental Alert process is very effective in getting alerts about unsafe conditions or issues out to the workforce in an expedited manner.

What are some of the success stories for BIW industrial safety?

- Reducing Hazardous Waste Disposal by 16% since 2001, and reducing solid waste disposal by 10% since 2001.
- Being an inaugural member of the ME DEP STEP-UP Program.
- Our outreach efforts through participation in various groups (MACOSH, NSRP, Marine Chemists Association, EPA/DEP Working Groups) have allowed us to increase our influence on the development of regulatory and industry issues, and allowed us to be very proactive in dealing with these changes.
- Having our EHS Management System certified to ISO 14001 and OHSAS 18001.
- Our Comprehensive Environmental Audit Program. This is a broad review of entire programs within the environmental area. Regulations, procedures, actual field conformance to procedures and improvement opportunities are covered. Audits are conducted on a rotating basis by personnel not responsible for day to day management of that program. This allows “fresh eyes” and cross-training.
- Implementation of a solvent recovery program to reduce hazardous waste.
- Implementation of a source segregation program for solid waste.

3. ORGANIZATIONAL OBJECTIVES & TARGETS

What organizational goals/targets have been established with respect to Environmental Management?

Objectives:

By January 1, 2006:

- Reduce Hazardous Waste disposal by 16% per DDG, based on 2001 levels.
- Reduce Solid Waste disposal by 10% per DDG, based on 2001 levels.
- Reduce energy consumption by 10% based on 2001 levels.

By January 1 2005:

Reduce the total number of Spills and Reportable Spills by 25% compared to 2003 levels.

Is BIW currently ISO 14001 certified?

YES

What challenges have been faced with regard to ISO 14001 certification?

There have been several challenges with regard to ISO 14001. The first was how to effectively integrate the program into existing culture and processes so that it was not perceived as a “new” paper program. BIW already had existing EHS control documents and ISO 9000 work instructions. The challenge became incorporating those existing and accepted documents into the overall management system.

A second challenge has been how to effectively communicate the EHS Policy. The policy has been distributed and discussed through a variety of means, but retention of the content of the Policy is still low.

During implementation we struggled with defining EHS monitoring equipment. This equipment requires maintenance and calibration. In many instances monitoring equipment can be in place for several reasons, not just EHS, so establishing a clear criteria was difficult.

What benefits have been realized from establishing a formal environmental management process?

- Increased awareness and involvement in environmental issues from Top Management through line employees.
- Formalized process for selecting improvement objectives.

4. POLICY & PLANNING

What attributes of your products, activities and services could have significant impacts on the environment?

Table E4-1 contains summary of BIW Significant Environmental Aspects and a description of each Aspect follows.

Table E4-1, Significant Environmental Impacts

Hazardous Waste	Direct Discharges
Blast & Paint Emissions	LLTF Noise
Solid Waste	Off-site Waste Water Disposal
Sewer Discharges	Spills & Spill Control
Storm Water	Electrical Use
Combustion Emissions	Impacts to Shortnose Sturgeon
Hazardous Materials Usage	

Blast and Paint Emissions - are the dust from blasting and the solvent evaporation and overspray from painting.

Combustion Emissions - are from fuel burning equipment.

Direct Discharges to the River - occur when wastewater is discharged directly into the river.

Sewer Discharge - occurs when wastewater is discharged into the sewer system.

Off-site Waste Water Disposal - occurs when waste waters created during processes must be shipped off-site for proper treatment and disposal and can not be directed to the sewer or the river.

Storm Water Discharges - occur when rain or snow melt runs into the river or storm collection system. This can carry pollutants or debris from the ground or other surfaces directly into the river.

Electrical Use - is an environmental concern because it forces the local power plants to burn more fuel and create air emissions.

Hazardous Material Use - is a concern because improper handling, spilling or disposal of this material could harm personnel or impact the environment.

Hazardous Waste Disposal – waste such as paints, solvents, and adhesives must be disposed of in proper locations to ensure proper final disposal.

NASA Questionnaire Matrix – Theme II: Environmental Management Define Requirements <PLAN>
--

LLTF Noise – The LLTF facility is limited to certain levels of noise during the day and at night.

Solid Waste Disposal – includes scrap metal, scrap wood, cardboard and general shipyard debris

Spills - occur when hazardous materials spill onto the ground or water.

Impacts to Endangered Species - refers to operations that could impact Shortnose Sturgeon living in the Kennebec River.

Has BIW encountered any organizational culture issues/challenges in establishing and maintaining an environmental management program?

The most significant organizational culture challenge has been getting people to embrace personal accountability for EHS issues. Oftentimes, EHS is seen as the EHS Division's issue or responsibility.

This translates through the entire line organization. Mechanics often do not take personal responsibility for EHS. For example, a common response from a mechanic not cleaning up a spill is that their supervisor did not tell them to. This is despite extensive training on spill requirements and oftentimes acknowledgement by the employee of the requirement. Additionally, some supervisors still view 'environmental' as the job of the Environmental Department.

5. GOVERNING DOCUMENTS

Describe the governing environmental management policies and procedures documents applicable to the BIW programs.

BIW has an Environmental, Health & Safety Management System Manual that identifies the core elements of the EHSMS. BIW's utilizes a hierarchical system of related documentation as shown in Figure E5-1 below. The categories of documents are as follows:

EHS Management System Manual – describes the core elements of the EHSMS in accordance with ISO 14001 and OHSAS 18001.

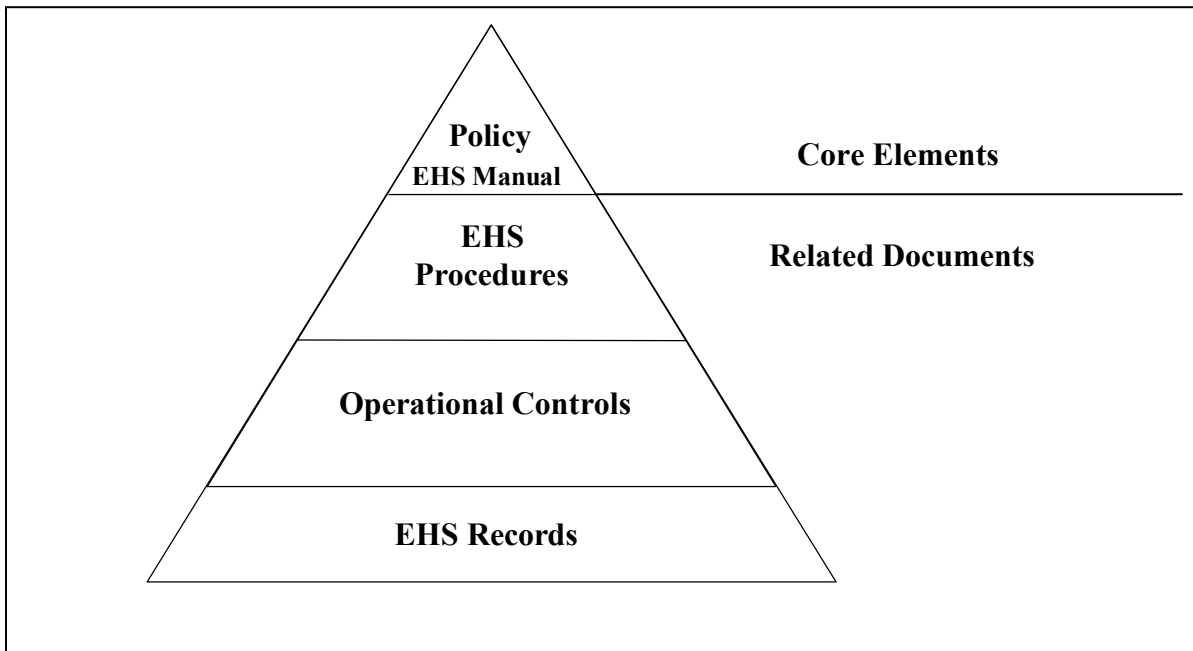
Environmental, Health & Safety Procedures (EHSP's) - are the procedures referenced in the EHS Manual that contain detailed information on specific parts of the EHSMS. Appendix B contains a listing of these procedures.

NASA Questionnaire Matrix – Theme II: Environmental Management
Define Requirements <PLAN>

Operational Controls – are related documents that provide instructions to ensure significant aspects and risks are controlled when appropriate.

EHS records – are related documents that provide evidence that the EHSMS activities are being implemented as required.

Figure E5-1, EHSMS Documentation Matrix



EHS Management System Manual – describes the core elements of the EHSMS in accordance with ISO 14001 and OHSAS 18001.

Environmental, Health & Safety Procedures (EHSP's) - are the procedures referenced in the EHS Manual that contain detailed information on specific parts of the EHSMS. Appendix B contains a listing of these procedures.

Operational Controls – are related documents that provide instructions to ensure significant aspects and risks are controlled when appropriate.

EHS records – are related documents that provide evidence that the EHSMS activities are being implemented as required.

Appendix A contains a list of the Environmental, Health & Safety Procedures and Appendix B contains a list of the “SPM’s.”

NASA Questionnaire Matrix – Theme II: Environmental Management
Define Requirements <PLAN>

Are there any additional requirements/incentive levied by the Department of the Navy?

Our contracts with the Navy invoke various EHS requirements into the contracts. In addition, overhaul work requires conformance to the Navy Standard Items, which include EHS requirements.

Are there any programmatic incentives related to safety?

The Navy does not have incentives for EHS performance, but there are contractual requirements to have specific programs in place to control EHS risks and to comply with various laws.

The current Labor Agreement limits types of recognition to only recognizing the entire company or section for company achievement; no personal achievement can be recognized.

NASA Questionnaire Matrix – Theme II: Environmental Management Implement Requirements <DO>

6. IMPLEMENTATION & OPERATION

How are resources provided for environmental management efforts?
--

Refer to Section 1-Organizational Structure for an overall description of how BIW manages EHS. BIW maintains a specialized staff to handle technical environmental issues. This group deals with compliance issues such as reporting, record keeping and procedure development. The staff includes:

- (1) Manager of Environmental Operations
- (3) Environmental Engineers
- Environmental Technician

ADHOC EHS Improvement Teams are formed to achieve EHS objectives and/or to address specific EHS issues. Teams are designated by Management and consist of personnel from various functional groups within the company.

7. TRAINING / AWARENESS

How often do employees receive environmental management-related training?

EHS training is provided at various frequencies and consist primarily of four types of training.

New Employee Orientation training is provided upon the employees first day of work at BIW.

“Safety” Talks are provided every week. These are a brief 15-minute session on EHS issues that occur every week of the year.

Specialized Training is typically provided on a less frequent basis as determined by regulations, contracts or risk analysis. A few examples of typical specialized training may include training on specific equipment operation, fuel transfers, fire-fighting, emergency responder, hazardous waste management, spray-painting, etc. This type of training is typically conducted on an annual basis, but may also occur more or less frequently as dictated.

On-The-Job Training is a critical part of any new or re-assigned employees training.

How are employees trained to understand why the organization needs an effective environmental management system (EMS)?
--

How are employees trained to understand their role in the EMS?
--

NASA Questionnaire Matrix – Theme II: Environmental Management Implement Requirements <DO>

Initial EMS Awareness Training was conducted through a series of “Safety Talks.” The Talks covered what an EMS is, why we have an EMS, the significant aspects and the objectives and targets of the EMS.

This is periodically reinforced through Safety Talks and other company communications.

Individual EHS responsibilities are incorporated in Operational Controls and reinforced through various training.

NASA Questionnaire Matrix – Theme II: Environmental Management
Verify Implementation <CHECK>

8. METRICS

What environmental management metrics are tracked?

How often are metrics recorded and reported?

To whom are metrics reported?

Table E9-1 below contains a summary of the type of metrics maintained, the frequency, and the parties receiving the data. The End of Month Environmental Metrics includes metrics for Hazardous Waste, Solid Waste, Energy and Spills.

Table E9-1, Environmental Metrics

Type of Metric	Frequency	Deliverable
Universal Safety Audit	Weekly	Manuf VP/Directors
Safety Talk Performance	Weekly	Manuf VP/Directors
End of Month Environmental Metrics	Monthly	Senior Management/Directors

9. REVIEWS / AUDITS

What reviews/audits are conducted to verify environmental management compliance?

How often are reviews/audits conducted?

Who participates in the reviews/audits?

Table E9-1 below contains information on EHS Audits;

Table E9-1, EHS Audits

Audit Type	Frequency	Whom
EHS Management System	Monthly	EHS Staff
Safety Inspections	Daily	EHS Staff
Scheduled inspections or audits	Varies according to schedule	Represented EHS Staff
Wall-to-Wall	Monthly	EHS Staff, Production, Maintenance
Behavior Audits	Weekly	All Management

NASA Questionnaire Matrix – Theme II: Environmental Management Verify Implementation <CHECK>

Examples of scheduled environmental inspections / audits include:

- SWP3 BMP Audits
- SPCC Inspection
- Hazardous Waste Collection Area Inspections
- Universal Waste Collection Audits
- Title V Air License Inspections

In addition, BIW conducts EHS Management System Management Reviews with senior Management every six months.

10. LESSONS LEARNED

How and where are lessons learned captured?

Lessons learned are captured during incident investigations, drills and training exercises.

How are past lessons learned transferred to new programs/work processes/other facilities?

Appropriate corrective action is initiated as a result of incident investigations, drills or exercises. Corrective actions ensure that lessons are incorporated into other areas of the company and/or into procedures.

Another effective way to quickly communicate lessons learned is through the “Scenario Talk” process. A Scenario Talk is a Safety Talk that goes out as part of the Safety Talk Weekly Package that contains a summary of a real event, such as significant spill or releases. The Talk covers what happened and what went wrong, including the root cause and any new procedural changes that may have resulted.

11. INCIDENT RESOLUTION

What types of incidents are reported?

How are these incidents reported?

Environmental incidents are reported through two mechanisms. First, BIW maintains a procedure for reporting environmental spills or releases. This procedure requires that all non-incidental releases must be reported to a central emergency number for proper response and investigation.

NASA Questionnaire Matrix – Theme II: Environmental Management Verify Implementation <CHECK>

Incidental Spills are small-quantity spills, drips, etc. that can be cleaned up by a mechanic without reporting provided the following criteria are met:

- the spill is of a known chemical;
- the individual has had appropriate HazCom training for the chemical; and
- it is within the ability of the mechanic to easily clean-up.

The second way environmental incidents are reported is through the procedure detailing when incidents must be reported. Serious accidents and serious incidents, as defined below, must be reported, and any environmental component is also addressed.

Serious Accident - any accident which results in death, hospitalization (admitted as in-patient), or severe trauma (amputation, second/third degree burns, fractures, loss of consciousness, respiratory disorders, severe lacerations, avulsions, crushing injuries, severe contact with electricity, etc.) to any person(s) on BIW property.

Serious Incident - any chain of events that result in a mishap which could have caused a serious accident, or events that result in the loss of property to BIW, subcontractors, Supervisor of Shipbuilding or any customer.

In addition, supervisors are responsible for completing root cause reports for any employee injured at BIW.

What steps are involved in a mishap investigation?

All facts of the incident are collected through physical inspection, interviews with employees directly involved or witness to the incident, and review of relevant records or other applicable data.

Describe your closed-loop corrective action process
--

EHS personnel identify nonconformities for the need for corrective action. Actions are assigned to the function(s) responsible for the nonconformance to correct them through one of the methods below.

Universal Data Collection Form (UDCF)

- UDCF's are issued by the EHS division to address short-term issues and are implemented by the appropriate function(s). These forms ensure complete closure of slips.
- UDCF's are tracked through completion and documented. Exception reports are generated and monitored to ensure all slips are closed.

Accident/Incident Investigation Reports

- Accident/Incident Investigation Reports are prepared by the EHS professional staff.
- Actions are documented within the Reports and are completed by the assigned function. Actions are tracked by the investigating engineer and remain open until completion.

“Safety / Environmental” Maintenance Work Order

- Work Orders are requested by any employee and implemented by the Facilities Division.
- Work Orders are tracked through the Maintenance Management System.

EHS Action Database

Actions that are not tracked through the above methods are entered into a database maintained by the EHS division and tracked through closure.

How are remote sites controlled/related to the BIW program?

All BIW Rules and Procedures apply to remote sites.

BIW employees working at a non-BIW site must adhere to the requirements of that site. This is due to the variance in environmental permits between sites and variations in local regulations in different States and regions.

12. CERTIFICATION AUDITS

What are the processes for verifying environmental management compliance throughout facility operations?

In addition to the audits identified in Table E9-1, EHS Audits, BIW has two surveillance audits per year of our EHS Management System conducted by a certified Registrar.

13. CERTIFICATION REVIEW PROCESS

Describe the processes that enable/provide management knowledge and understanding of environmental management issues.

EHS Management reviews are conducted every 6 months or more frequently as determined by Top Management. The EHS Division prepares the necessary information for Top Management to evaluate the system. Top Management reviews the information presented about the EHS Policy, Significant Aspects/Risks, Objectives and Targets, Internal Audit Findings and other relevant data. The information is used to evaluate and understand the effectiveness and continuing suitability of the EHS management system and issues associated with it.

In addition metrics are provided to management on a routine basis, as are weekly “highlights” of key EHS issues.

Describe how Objective Quality Evidence (OQE) is gathered and documented to demonstrate environmental processes are fully implemented.

What oversight or audits are used to verify the quality and technical adequacy of environmental management implementation?

Both internal and external sources are used to provide objective evidence and to verify the quality of the EHS program.

External Data such as, Customer Feedback, NOV’s / Citations, Registrar Findings, Public Complaints, Corporate Review findings.

Internal Data such as, Accident/ Incident Reports, Universal Data Collection Results, EHS Work Order Status, Performance on Action Plans and various performance metrics are utilized to monitor objectives and targets as well as other elements of the EHS Management System.

THEME III: EMPLOYEE WELLNESS

1. ORGANIZATIONAL STRUCTURE

Where in the organization does the responsibility and authority for employee wellness programs lie?

The Building Healthy Ways program administratively reports to the Employee Benefits organization but coordinates closely with both the Medical and Safety organizations, which also operate within the Human Resources division.

2. HISTORY / OVERALL PERSPECTIVE

Describe the history / evolution of the BIW employee wellness program.

Prior to 2001, BIW had a wellness benefit for certain qualifying programs and activities. Program management was largely an accounting / reimbursement activity. Beginning in 2001, a dedicated program manager was hired to implement a significantly expanded program. All program development efforts were designed to respond to the results of an initial employee interest survey with additional guidance and advice from a steering committee of employees from all represented and salaried employee groups.

In what areas has BIW been particularly effective?

Participation rates for a manufacturing workforce with BIW's demographic profile have been approaching 41% for employees actively following through with activities and survey responses.

What are some of the success stories for BIW employee wellness?

There are a range of success stories but they all share a common theme: employees taking an active role in making informed health decisions related to behavior modification and disease management.

3. ORGANIZATIONAL OBJECTIVES AND TARGETS

What organizational goals / targets have been established with respect to employee wellness?

A major goal is to expand employee participation to 75% in 2006.

**NASA Questionnaire Matrix – Theme III: Employee Wellness
Management / Organization**

What benefits have been realized from establishing a formal employee wellness program?

The creation of a formal employee wellness program has created a clear forum where health issues can be presented in an atmosphere of shared concern.

4. IMPLEMENTATION & OPERATION

How are resources provided for employee wellness programs?

The Building Healthy Ways program administratively reports to the Employee Benefits organization but coordinates closely with both the Medical and Safety organizations which also operate within the Human Resources division.

5. TRAINING / AWARENESS

What specific employee wellness programs are offered by BIW?

BIW's wellness program offers support in the following areas:

- Screenings
 - Blood pressure
 - Blood Sugar
 - Cholesterol
 - Total Lipids
 - Pulmonary Function
 - PVD
 - Skin Analysis
 - Body Mass Index
 - Body Fat Composition
- Flu Clinic
- Wellness Reimbursement
- Activity Programs
- Nutrition
- Physical Activity
- Volunteerism
- Domestic Violence Prevention
- Tobacco Cessions
- Combined Physical Activity / Nutrition
- Weight Maintenance
- Self Care / Self Management

NASA Questionnaire Matrix – Theme III: Employee Wellness
Verify Implementation <CHECK>

6. METRICS

Are quantifiable metrics or other observable benefits metrics related to employee wellness tracked?

Self Care Book Example: 2003 survey data indicated that respondents who used the self-care book avoided an estimated \$64,000 in unnecessary ER visits and \$17,095 in unnecessary doctor's visits. The cost of the book was \$4.95 each for 6,800 employees. Based only on the 55% of the 1,447 survey participants who felt they had avoided costs, the net savings was \$47,435 – a ROI of \$2.41:1.

Detailed Program Participation / Penetration Rates: Maintain the ability to see not only how many people participate in a particular program but also know how many different programs an individual employee / family members decide to participate in.

7. REVIEWS / AUDITS

Are any reviews / audits conducted to verify effectiveness of employee wellness programs?

BIW's wellness program has used direct employee surveys as well as 3RD party evaluations to help determine the effectiveness of existing programs and the potential effectiveness of any proposed new activities.

Information is currently being collected to enable additional assessments.

Modifiable risks analysis
Health Claim Analysis
Utilization of Disease Management programs.

NASA Questionnaire Matrix – Appendix E.1
Environmental, Health & Safety Procedures (EHSP's)

**Appendix E.1 – Environmental, Health & Safety Procedures
(EHSP's)**

14001 /18001 Clause	Description	Title	EHS Procedure No.
4.3.2	Legal and other requirements	Environmental, Health & Safety Legal & Other Requirements	01-1
4.3.1	Aspects / Risk Identification	Identification of Environmental Aspects	02-1
		Identification of Health and Safety Risks	02-02
		Environmental, Health and Safety Review of Projects and Process Change	02-03
4.3.3	Objectives & Targets	EHS Objectives & Targets	03-1
4.3.4	Management Programs	EHS Objectives & Targets	03-1
4.4.2	Training, awareness and competence	Environmental, Health & Safety - Training, Awareness and Competence	04-1
4.4.3	Communication	Environmental, Health & Safety Communication	05-1
4.4.5	Document Control	EHS Document Control	06-1
4.4.6	Operational control	EHS Operational Control	07-1
4.4.7	Emergency preparedness and response	Environmental, Health & Safety Emergency Preparedness and Response	08-1
4.5.1	Monitoring and measurement	Environmental, Health & Safety Compliance Auditing	09-1
		EHS Monitoring and Measurement	09-2
4.5.2	Nonconformance and corrective and preventive action	EHS Accident/Incident Investigation, Nonconformance and Corrective & Preventive Action	10-1
4.5.3	Records	Environmental, Health & Safety Records	11-1
4.5.4	EMS audit	Internal EHS Management System Audit	12-1
4.6	Management Review	Environmental, Health & Safety Management Review	13-1

Appendix E.2 – List of SPM's

ENVIRONMENTAL, HEALTH AND SAFETY PROCEDURES

SAFETY

PROCEDURE	TITLE	REVISION	DATE ISSUED/ REVISED
SPM-S-01	Internal Wall-to-Wall Inspections	B	09/03/03
SPM-S-02	Red Tag/Job Shutdown	B	01/30/04
SPM-S-03	Safety and Health Serious Accident/Incident Reporting Procedure	C	08/18/03
SPM-S-04	Emergency Evacuation of Injured Personnel: Use of Gantry Cranes	Baseline	08/21/00
SPM-S-05	Head, Face, Eye, Hand and Feet Protection	Baseline	12/18/03
SPM-S-06	Ordnance Handling	B	12/19/03
SPM-S-07	Temporary Fall Protection Guidelines	A	11/01/03
SPM-S-08	Spy Array Staging - CG -		INACTIVE
SPM-S-08A	Spy Array Staging - DDG -	Baseline	07/04/01
SPM-S-09	Effective Grounding	B	03/05/04
SPM-S-10	Safety Audit Program (combined with SPM-S-31)		INACTIVE
SPM-S-11	Warning Tape and Signs	C	07/29/03
SPM-S-12	Welding Current Return & Unit Grounding	A	12/03/02
SPM-S-13	Emergency Eye Wash/Shower Installation/Inspection Procedure	B	07/26/04
SPM-S-14	Welding Cable Repair	B	10/16/03
SPM-S-15	Safety Precautions for Working Around Hot Piping Systems	Baseline	11/07/03
SPM-S-16	Diving Operations		INACTIVE
SPM-S-17	Hydroblasting		INACTIVE
SPM-S-18	Thawing Frozen Pipes		INACTIVE
SPM-S-19	Safe Practice for Work "Over the Side"	B	03/28/03
SPM-S-20	Safe Operation Transmitting and/or Rotating Shipboard Antennas		INACTIVE
SPM-S-21	Lockout/Tagout Program	Baseline	12/20/01
SPM-S-22	Sky Climber Procedure		INACTIVE
SPM-S-23	Ladder Climbing Device Safety Procedure	C	05/27/04
SPM-S-24	Contractor Safety Requirements	A	11/13/03
SPM-S-25	Procedure for Two Crane Lifts	A	12/12/03
SPM-S-26	Installation Lifting Lugs, Clips, All Pads		INACTIVE
SPM-S-27	Suspended Personnel Platforms	C	12/23/03

NASA Questionnaire Matrix – Appendix E.1 Environmental, Health & Safety Procedures (EHSP's)
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	Safety Program for BIW Employees Assigned to Offsite Out-of-State or Int'l Programs	B	09/04/03
SPM-S-29	Plywood Decking	A	10/30/03
SPM-S-30	Response to Spilled Blood and Body Fluids in the Work Environment	D	03/03/04
SPM-S-31	Universal Data Collection Program	A	12/16/03
SPM-S-32	OPEN		
SPM-S-33	Safety Talk Program	A	12/16/03
SPM-S-34	Rented or Leased Equipment or Machinery	A	12/31/02
SPM-S-35	Below the Hook Lifting Devices		INACTIVE
SPM-S-36	Safe Use of Paint Warming Cabinets	A	12/23/03
SPM-S-37	Pylon Inspection Program (Pipe & Sawhorse)	Baseline	11/22/03
SPM-S-38	Injury Investigation Report Process	Baseline	04/14/03

NASA Questionnaire Matrix – Appendix E.1 Environmental, Health & Safety Procedures (EHSP's)
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ENVIRONMENTAL, HEALTH AND SAFETY PROCEDURES

INDUSTRIAL HYGIENE

PROCEDURE	TITLE	REVISION	DATE ISSUED/ REVISED
SPM-IH-02	Using Chlorinated Solvents	A	09/03/03
SPM-IH-03	BIW Respiratory Protection Program	C	09/22/03
SPM-IH-04	Lead Compliance Program	Baseline	07/04/01
SPM-IH-05	Hazard Communications Program	B	02/26/04
SPM-IH-06	Working with Man Made Fibers	A	07/01/04
SPM-IH-07	Controlling Man Made Mineral Fiber Thermal Insulating Material for Contracts Invoking NAVSEA Standard Items		INACTIVE Absorbed into SPM-IH-06
SPM-IH-08	Hot Work and Coated Surfaces	A	05/08/02
SPM-IH-09	Microwave Radiation Safety Procedure	A	03/02/04
SPM-IH-10	Asbestos Abatement Program	B	03/08/04
SPM-IH-11	BIW Cadmium Compliance Program	Baseline	07/04/01
SPM-IH-12	Heat Stress Management	A	10/15/03
SPM-IH-13	Hearing Conservation Program	D	11/14/03
SPM-IH-14	Laser Safety Program	A	11/14/03

TRAINING

SPM-T-01	Certification Procedure - Mobile Equipment (General)	A	12/12/03
SPM-T-02	Certification Procedure-Bridge, Mobile, Portal, and Truck Cranes	A	07/04/03
SPM-T-03	Certification Procedure-Maintenance Personnel (merged with SPM-T-01)		INACTIVE
SPM-T-04	Motorboat Operation Training & Certification	A	01/06/04
SPM-T-05	Certification Procedure –Mobile Equipment Instructors	A	11/12/03
SPM-T-06	Safe Behavior Audit Program		INACTIVE
SPM-T-07	Training and Certification Procedure: Oxygen Fuel Equipment	B	03/08/04
SPM-T-07A	Training Procedure/Oxygen Fuel Equipment (incorporated into SPM-T-07)		INACTIVE

NASA Questionnaire Matrix – Appendix E.1 Environmental, Health & Safety Procedures (EHSP's)
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ENVIRONMENTAL/LABORATORY

SPM-EL-01	Safe Entry into Confined Spaces	C	12/11/03
SPM-EL-02	Environmental Requirements/Best Management Practices Ships in Dry Dock		INACTIVE (Merged with SPM-EL-15)
SPM-EL-03	Reporting and Cleanup of Oil Spills/Hazardous Substances	B	09/17/03
SPM-EL-04	Spray Painting Operations	B	08/06/03
SPM-EL-05	Service Tunnel Entry-Portland Ship Repair Facility		INACTIVE
SPM-EL-06	Hazardous Waste Operations Procedure	C	05/17/04
SPM-EL-07	Transitional Period for Vessels and Vessel Sections Training Requirements	A	09/04/03
SPM-EL-08	Oily Water Transfer Operations	B	12/19/03
SPM-EL-09	Ozone Depleting Substances Compliance Policy	A	08/04/03
SPM-EL-10	Safe Work Practices for Shipboard & Land-side Sewage Systems	B	04/09/03
SPM-EL-11	Gas-Freeing and Hot Work Control on Vessels and Vessel Sections	D	08/03/04
SPM-EL-12	Procedure for The Control of Mercury	C	10/17/03
SPM-EL-13	Excess Material Handling – GFM	B	02/06/03
SPM-EL-14	Excess Shelf-Life Material Handling-CFM	B	02/12/03
SPM-EL-15	Environmental Requirements and Best Management Practices	C	01/31/03
SPM-EL-16	Environmental Requirements for the Distribution and Handling of Marine Coatings	C	12/04/03
SPM-EL-17	Requirements For Environmental Recordkeeping	C	11/06/03
SPM-EL-18	Citizen Noise Complaint Protocol	A	05/08/03
SPM-EL-19	Test and Inspection for the Fabrication and Installation of Reuseable Lifting Pads	Baseline	10/23/01
SPM-EL-20	Solid Waste Management Procedure	B	02/23/04
SPM-EL-21	Treatment and Disposal of Wastewater	A	03/01/03
SPM-EL-22	BMPs for Noise Control	A	04/28/04
SPM-EL-23	Operating Procedures for Hazardous Waste Facility Personnel	A	05/17/04
SPM-EL-24	Universal Waste Handling	A	02/23/04
SPM-EL-25	Procedure for Fueling Over-the-Water	Baseline	05/05/03
SPM-EL-26	Proper Handling and Disposal of Snow	Baseline	11/7/03

NASA Questionnaire Matrix – Appendix E.1 Environmental, Health & Safety Procedures (EHSP's)
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SHIPYARD INFORMATION MEMOS

MEMO #	TITLE	DATE ISSUED/ REVISED
0002	Access and Emergency Escape Trunk Platforms	11/3/94
0004	Ventilation Requirements for Spray Painting in Enclosed and Confined Spaces (Replaces Shipyard Memo #1714)	11/17/94
1633	Removal of Safety Hardware	04/01/92
1642	Employee Access to Exposure and Medical Records	03/19/92
1666	Oxygen - Burning Gas Safety	07/19/95
1674	Household Electrical Appliances in Office or Production Work Areas	03/06/96
1714	Ventilation Requirements for Spray Painting in Enclosed and Confined Spaces	09/02/93
1724	Foot Wear	04/07/92
1753	Life Rings	04/07/92
1837	Emergency Escape Trunk Trade Platforms	02/08/93
1842	Clarification of SPM-S-11	03/30/93
1844	Ventilation for Spray Operations	04/01/93
1903	Crane Suspended Personnel Lifting	06/15/94
1918	Opening of Confined Spaces and Performing Hot Work- Training	10/03/94
--	Elimination of Two Wheeled Bicycles	04/06/94

Appendix E: Glossary

APPL	Academy of Program and Project Leadership
BIW	Bath Iron Works
CAIB	Columbia Accident Investigation Board
CD	Center Director
CG	Guided Missile Cruiser
CMS	Competency Management System
EHS	Environmental, Health & Safety
EHSMS	Environmental, Health & Safety Management System
EHSP	Environmental, Health & Safety Procedure
ESCCI	Enhanced Safety Culture Communication Initiative
FFG	Guided Missile Frigate
ISO	International Organization for Standardization
JHA	Job Hazard Analysis
KSC	Kennedy Space Center
LLTF	Land Level Transfer Facility
LTIR	Lost Time Injury Rate
MHMC	Maine Health Management Coalition
MOAs	Memoranda of Agreement(s)
MOUs	Memoranda of Understanding(s)
NAVSEA	Naval Sea Systems Command
NNBE	NASA/Navy Benchmarking Exchange
NR	Naval Reactors
OHMS	Office of Health and Medical Systems
OHSAS	Occupation Health and Safety Assessment System
OSHA	Occupational Safety and Health Administration
OSMA	Office of Safety and Mission Assurance
PPE	Personal Protection Equipment
PTA	Physical Task Analysis
RADM	Rear Admiral
SCCI	Safety Culture Communication Initiative
SCDM	Safety Critical Decision Making
SMA	Safety and Mission Assurance
SPM	Safety Procedure Manual
SUBSAFE	Navy Submarine Safety
VPP	Voluntary Protection Program